INSTRUCTION BOOK

FOR

AMPLIFIER-POWER SUPPLY GROUP AN/TRA-19

MANUFACTURED BY
PACKARD-BELL CO.
ORDER NO. 3172-PH-51-93
16 OCTOBER 1952

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WARNING

HIGH VOLTAGE

IS USED IN THE OPERATION
OF THIS EQUIPMENT.

DEATH ON CONTACT

may result if personnel fail to
observe safety precautions.

Be careful not to contact high-voltage connections or 115-volt input connections when working on or near this equipment. When working inside the equipment, after the power has been turned off, always short-circuit the high-voltage capacitors.

Note. This equipment is designed with interlock switches that automatically disconnect the a-c input voltage when the chassis are pulled forward approximately ½-inch out of the case. These interlock switches are provided to remove the hazard of dangerous high-voltage shock when handling the equipment outside the case. Interlock shorting switches also have been provided to enable servicing personnel to restore the alternating-current input voltage when working on the equipment outside the case. **BE SURE ALL HIGH-VOLTAGE HANDLING PROCEDURES ARE OBSERVED CAREFULLY WHEN TROUBLE-SHOOTING EQUIPMENT THAT IS REMOVED FROM THE CASE.**

CONTENTS

LIST OF ILLUSTRATIONS

First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only,* remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

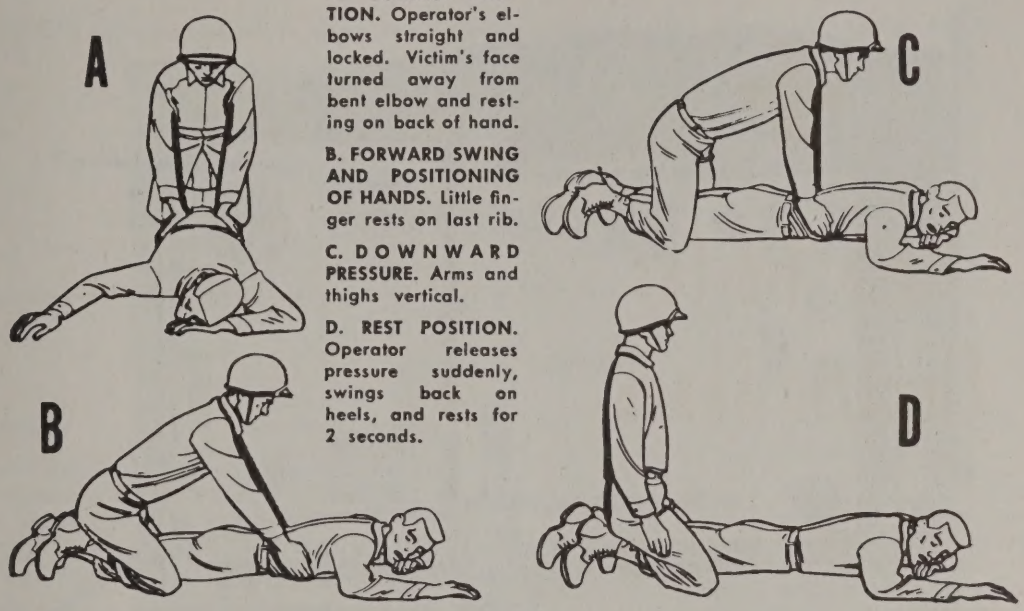
f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit up on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4



A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.

B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.

C. DOWNWARD PRESSURE. Arms and thighs vertical.

D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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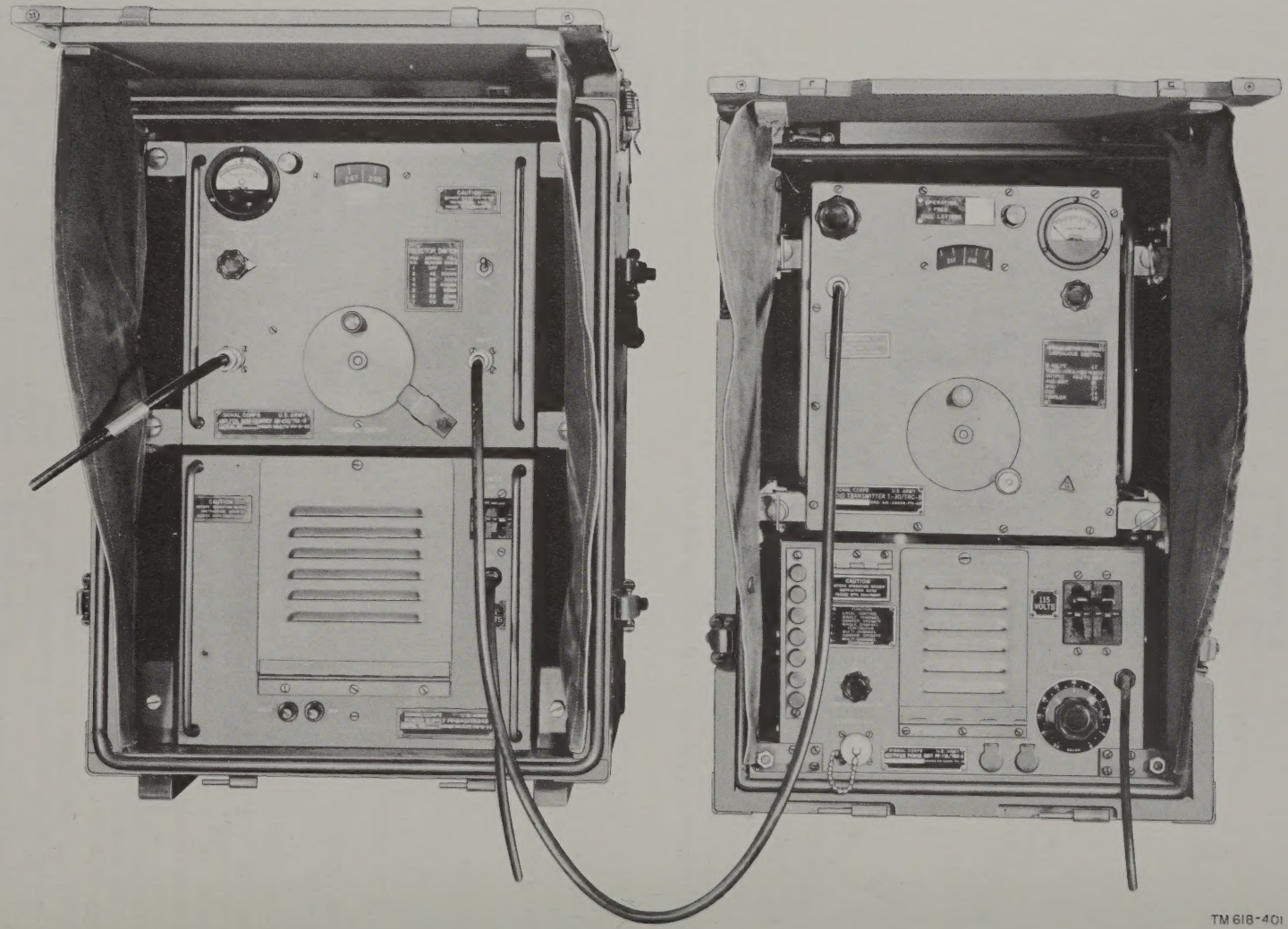


Figure 1. Amplifier-Power Supply Group AN/TRA-19, with Radio Transmitter T-30()/TRC-8.

Note. This instruction book will be replaced by TM 11-618, which, when published, will be listed in SR 310-20-4.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This instruction book contains descriptive material and instructions for the installation, operation, maintenance, and repair of Amplifier-Power Supply Group AN/TRA-19. Reference is made to the use of this equipment with Radio Set AN/TRC-8 ( ), Radio Terminal Set AN/TRC-11 ( ), and Radio Relay Set AN/TRC-12 ( ). In addition, there are two appendixes covering a list of references and an identification table of parts.

b. Since the equipment covered in this instruction book is of an auxiliary or optional nature to be used with Radio Set AN/TRC-8( ), Radio Terminal Set AN/TRC-11 ( ), and Radio Relay Set AN/TRC-12 ( ), the text contains frequent references to the instruction book for these three equipments.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71-4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. USAF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

d. DA AGO Form 11-238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 10).

e. DA AGO Form 11-239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 11).

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Note. Basic nomenclature followed by ( ) with no number or symbol in parenthesis refers to all models of the equipment, regardless of past, or present procurement.

a. Amplifier-Power Supply Group AN/TRA-19 is auxiliary equipment for specific use with Radio Transmitter T-30 ( )/TRC-8 which is a major component of Radio Set AN/TRC-8 ( ), Radio Terminal Set AN/TRC-11 ( ), and Radio Relay Set AN/TRC-12 ( ). Its purpose is to amplify the nominal power output of the transmitter from 5 to 75 watts, thereby increasing the reliability of the system. This additional output provides improved transmission over long distances, grazing paths, shadow areas, and other adverse conditions likely to be encountered in the field.

b. The use of this equipment for short range communication when direct transmission paths are available may be considered optional.

4. System Application

Application of this equipment in a multichannel radio-relay communication system, a multichannel point-to-point communication system, or a single-channel communication system is possible. For a complete description of the three systems, refer to the instruction book for Radio Set AN/TRC-8 ( ), Radio Terminal Set AN/TRC-11 ( ), and Radio Relay Set AN/TRC-12 ( ).

5. Technical Characteristics

Power Input .....400 watts maximum.
Frequency Range .....230 to 250 mc (megacycles) continuous tuning.
Amplifier Type .....Class C amplifier.
R-f Driving Power .....Five watts nominal driving power. Operates satisfactorily with an input variation from 4 to 10 watts.
Bandwidth .....Approx. 2 mc at 1/2 power level.
Power Output .....75 watts nominal.
Operating Range (line-of-sight) .....100 miles (max.).
Type of Tuning .....Coaxial cavity with non-shorting plunger.
Number of Tubes .....7 tubes (1 crystal, type 1N21A).
Weight .....164.2 lbs.

6. Packaging Data

a. When packaged for export shipment, the components of Amplifier-Power Supply Group AN/TRA-19 are packed in one wooden box, 26-7/16 inches high, 27-7/16 inches wide, 44-1/8 inches long, 13.66 cubic feet volume, and a unit weight of 275 pounds. Refer to figure 3 for a cutaway view of the equipment packed for export shipment.

Note. Items may be packaged in a manner different from that shown, depending on supply channel.

b. The following are the contents of the case:

(1) One Amplifier-Power Supply Group AN/TRA-19 with spare tubes, fuses, cords, and pilot lamps separately packed. See paragraph 12 for list of running spares.

(2) Two instruction books packed in the carrying case next to the amplifier.

(3) One Cord CG-55/U (4-foot) separately packed.

(4) One Cord CG-55/U (4-foot) packed in the carrying case next to the amplifier.

7. Table of Components

Component	Required No.	Height (in.)	Width (in.)	Depth (in.)	Volume (cu. ft.)	weight (lb.) Unit
Electrical Standardized Components Case CY-1204/TRA-19	1	26-1/2	18-3/8	17-3/4	4.01	53.
Radio Frequency Amplifier AM-456/TRA-19	1	11	12-7/8	13-11/16		46.
Power Supply PP-840/TRA-19	1	10-1/2	12-7/8	14-3/4		64.
Cord CG-55/U	1					1.2

8. Description of Radio Frequency Amplifier AM-456/TRA-19

a. Radio Frequency Amplifier AM-456/TRA-19 (fig. 2) is a single tube class C amplifier for operation on frequencies between 230 and 250 mc. Tuning is accomplished by means of a coaxial cavity with a non-shorting plunger. Tuning of the amplifier is accomplished by means of a single tuning dial located on the front panel.

b. A meter and meter selector switch are provided on the front panel for monitoring the various circuits of the amplifier such as PLATE VOLTS, SCREEN VOLTS, CATHODE CUR., SCREEN CUR., GRID CUR., and PWR. OUT. Proper meter readings for these circuits are shown on a label attached to the front panel.

c. Also on the front panel are an OPERATE-TUNE switch, an indicator lamp, and INPUT and ANTENNA receptacles. The amplifier is mounted in the upper portion of Electrical Standardized Components Case CY-1204/TRA-19. Side, top, and bottom views of the amplifier are shown in figures 24 through 27.

9. Description of Power Supply PP-840/TRA-19

a. Power Supply PP-840/TRA-19 converts an external source of a-c (alternating-current) power (115 or 230 volts) to the voltages required for operation of Radio Frequency Amplifier AM-456/TRA-19.

b. Mounted on the front panel is a lever, for setting the POWER ON-OFF switch, and screw-in type fuse holders for SCREEN and BIAS circuits.

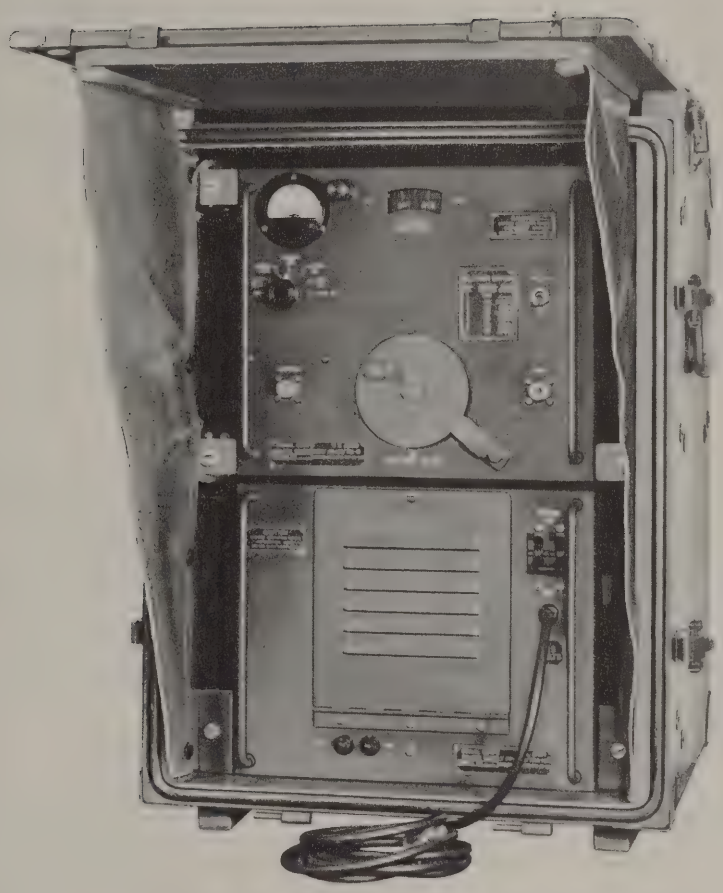
c. The access door on the front panel provides for ease in replacing tubes, setting the 115- or 230-volt operational switches (S101 and S102), and adjusting the SCREEN VOLTAGE ADJUST potentiometer (R112). The power supply is mounted in the lower portion of Electrical Standardized Components Case CY-1204/TRA-19. Top, bottom, and side views of the power supply are shown in figures 28 through 31.

10. Description of Electrical Standardized Components Case CY-1204/TRA-19

The plywood case is splashproof when closed and is designed to house Radio Frequency Amplifier AM-456/TRA-19 and Power Supply PP-840/TRA-19 when in transit or during field use. It contains a shock mounting into which the amplifier slides and locks. The front cover must be open while the equipment is operating (fig. 1). Flaps, attached to the front cover, are provided as protection against adverse weather conditions. The case may be carried by means of folding handles mounted on each side.

11. Description of Cord CG-55/U (fig. 38)

Cord CG-55/U is a 4-foot length of flexible, solid-dielectric, plastic-jacketed coaxial r-f (radio-frequency) cable (RG-8A/U). It is fitted at each end with a water-



TM 618-402

Figure 2. Components of Amplifier-Power Supply Group AN/TRA-19.

proof connector, Radio Frequency Plug UG-21B/U. This cord is used to connect the output (antenna receptacle) of Radio Transmitter T-30( )/TRC-8 to the INPUT of Radio Frequency Amplifier AM-456/TRA-19. Its characteristic impedance is 50 ohms.

12. Running Spares

A group of running spares is supplied with each equipment and is stored in a moisture proof foil bag packed in the shipping container. Spares are provided for all normally expendable items, such as tubes, pilot lamps, and fuses.

Following is a list of running spares:

1 tube 4X150A
2 tubes 5R4WGY
1 tube 6AQ5
1 tube 12AT7
1 tube 5651
1 crystal 1N21A
1 pilot lamp GE type #47
2 fuses, 1/32 ampere, Littelfuse type 3AG
1. Cord CG-55/U (4-ft length)

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF AMPLIFIER — POWER SUPPLY GROUP AN/TRA-19

13. Siting

a. Since this equipment is of an auxiliary nature, its operation and installation is dependent on the equipment with which it is used. Refer to the instruction book for Radio Set AN/TRC-8 ( ), Radio Terminal Set AN/TRC-11 ( ), and Radio Relay Set AN/TRC-12 ( ) for complete information on siting, line of sight, plotting profiles, and other important instructions concerning the selection of a location that will provide the best transmission and reception conditions.

b. The use of the AN/TRA-19 equipment will not necessitate relocating the antenna. Satisfactory communications may be obtained in spite of a poor antenna location.

14. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment, refer to paragraph 18.

a. Amplifier-Power Supply Group AN/TRA-19 is packaged for oversea and domestic shipment. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the permanent or semipermanent installation of the equipment. The instructions given in figure 3 apply to equipment shipped in export packing cases. No special instructions are required for opening the waterproof paper barrier and removing the equipment from domestic packing cases. Aside from checking to make sure carrying cases are present and that the equipment is undamaged, no special unpacking and uncrating procedures are necessary for equipment shipped in carrying cases.

Caution: Be careful in uncrating, unpacking, and handling the equipment; it is damaged easily. If it becomes damaged or exposed, a complete overhaul might be required, or the equipment might be rendered useless.

b. Open the cartons that protect the equipment and remove the components. Check the contents of the packing case against the master packing slip.

Note. Save the original packing cases and materials from both export and domestic shipment. They can be used again when the equipment is repacked for storage or shipment.

15. Installation of Equipment

a. Remove the front cover from Electrical Standardized Components Case CY-1204/TRA-19 and place it on top of the case. If the equipment is to be used in the open, attach the canvas protective flaps. Check to see that all tubes are seated firmly in their proper sockets. All tubes in the power supply are accessible through the access door on the front panel. Amplifier tube V1 is mounted in the cavity in such a manner that it will not become unseated during transportation.

b. Be sure the equipment is placed alongside Radio Transmitter T-30( )/TRC-8, as shown in figure 1.

16. Line Voltage

Amplifier-Power Supply Group AN/TRA-19 can be operated on 115 or 230 volts ac. Switching from one voltage to the other is accomplished by operating switches S101 and S102 located on top of the power supply chassis (fig. 28). These switches may be reached through the access door on the front panel. A locking bar, secured to the chassis by two screws, fits over the switch levers for the purpose of keeping both switches at the same setting. Be sure this bar is replaced when the switches have been set. It also will be necessary to change the position of the front panel voltage indication plate to correspond with the switch setting.

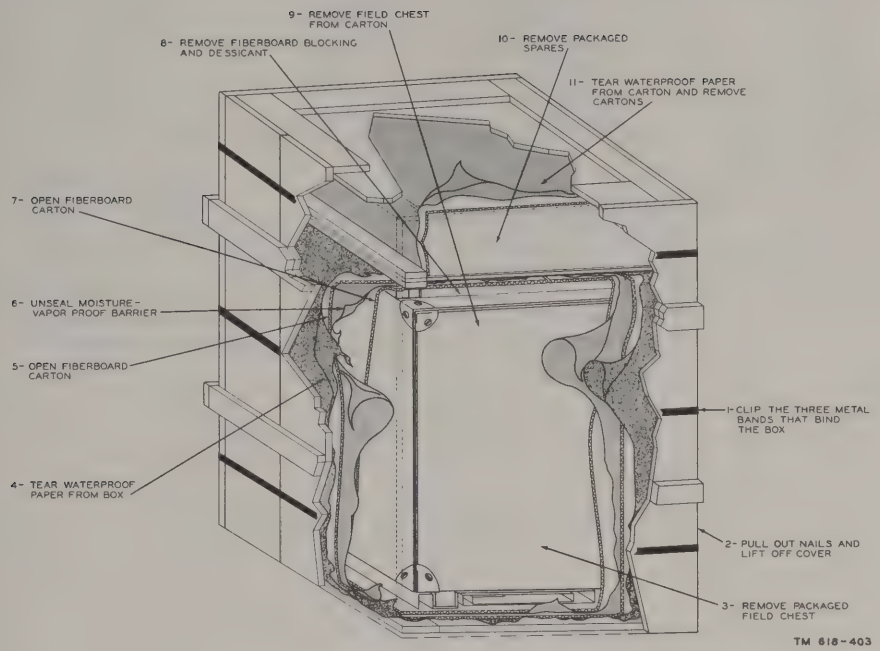


Figure 3. Typical component unpacking procedure.

17. Connections

(figs. 4 and 5)

a. GENERAL. Since this equipment is used specifically with Radio Transmitter T-30 ( )/TRC-8, it is connected in the same manner to Radio Set AN/TRC-8 ( ), Radio Terminal Set AN/TRC-11 ( ), and Radio Relay Set AN/TRC-12 ( ).

b. LOCATION. Locate Amplifier-Power Supply Group AN/TRA-19 immediately adjacent to Radio Transmitter T-30 ( )/TRC-8 as shown in figure 1 and proceed with the following connections:

(1) Remove the 60-foot cable (Cord CG-55/U) from the ANTENNA receptacle on Radio Transmitter T-30 ( )/TRC-8 and connect one end to the ANTENNA receptacle on Radio Frequency Amplifier AM-456/TRA-19. Connect the other end to the antenna.

(2) Connect the 4-foot cable (Cord CG-55/U) between the ANTENNA receptacle on the transmitter and the INPUT receptacle on the amplifier.

(3) Connect the 10-foot power cord running from the power supply to Junction Box JB-110.

18. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 14 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications of changes in the wiring of the equipment. If any changes in wiring have been made, note the change in this instruction book, preferably on the schematic diagram.

c. Check the operating controls for ease of rotation. It any difficulty is encountered refer to the maintenance instructions in Chapter 3, Section II.

d. Perform the installation and connection procedures as given in paragraphs 15, 16, and 17.

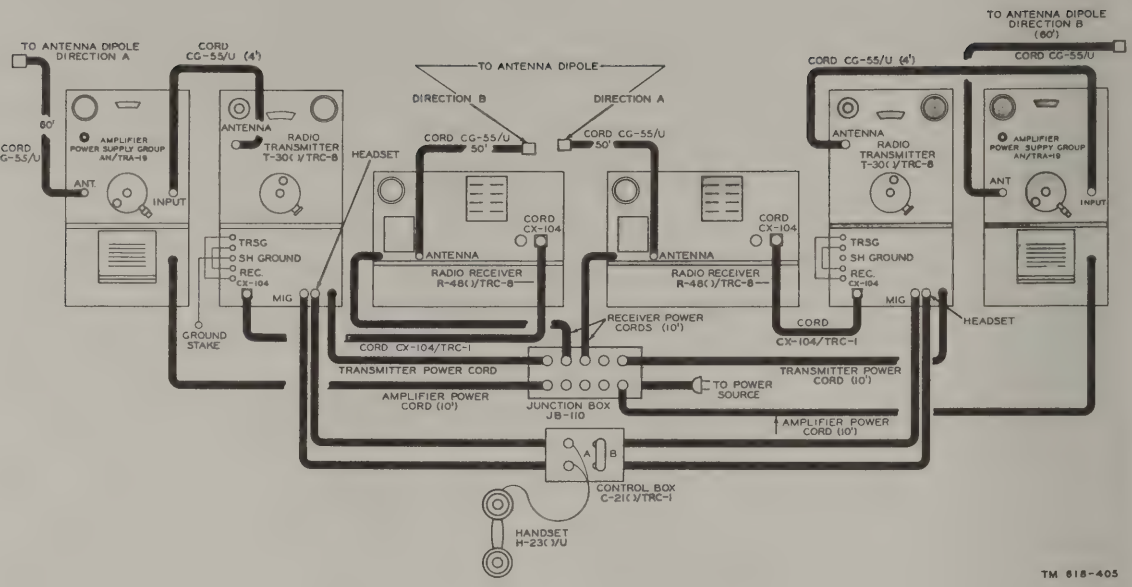


Figure 4. Relay station cording diagram, using Amplifier-Power Supply Group AN/TRA-19.

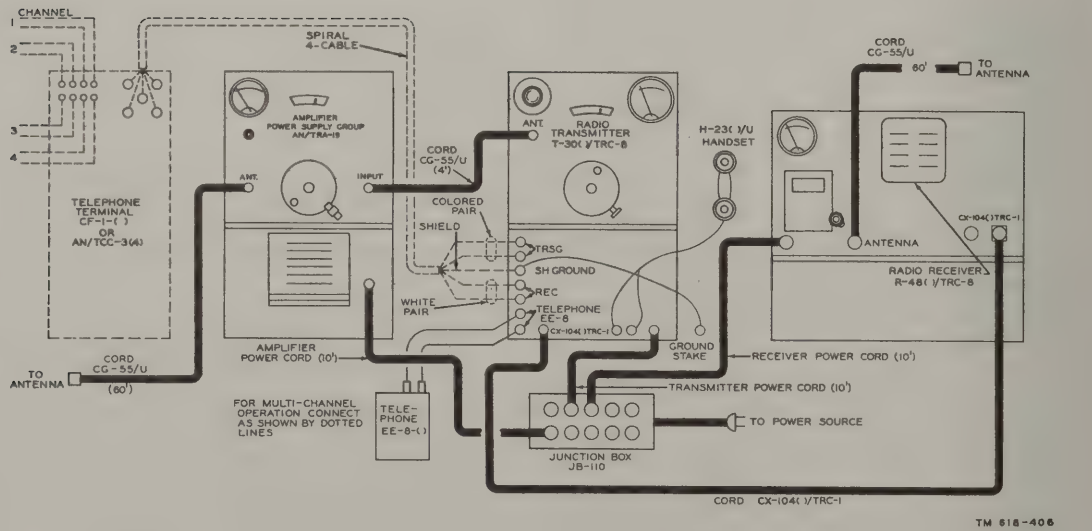


Figure 5. Terminal station cording diagram, using Amplifier-Power Supply Group AN/TRA-19.

Section II. CONTROLS AND INSTRUMENTS

19. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of the equipment is discussed in Section III of this chapter.

20. Radio Frequency Amplifier AM-456/TRA-19 Controls

(fig. 6)

The following table lists the controls of the amplifier and indicates their functions:

<table>
<tr><th>Control</th><th colspan="2">Function</th></tr>
<tr><td>FREQUENCY CONTROL knob and FREQUENCY MEGACYCLES dial</td><td colspan="2">Control operating frequency of amplifier. The dial is calibrated to give the approximate reading in megacycles. Rotation of dial control knob tunes amplifier to desired frequency. A dial lock has been provided to prevent the dial from shifting after it has been set.</td></tr>
<tr><td>OPERATE-TUNE switch (S3)</td><td colspan="2">Prevents damage to tubes during rapid tuning or adjustments. In TUNE position, voltage applied to screen of amplifier tube (V1) is decreased, which lowers power output and plate dissipation. Switch is set to OPERATE when equipment is functioning as part of a communication system.</td></tr>
<tr><td>ANTENNA receptacle (J3)</td><td colspan="2">Receives Radio Frequency Plug UG-21B/U of Cord CG-55/U (4-foot length) connecting the antenna to the amplifier.</td></tr>
<tr><td>INPUT receptacle (J4)</td><td colspan="2">Receives Radio Frequency Plug UG-21B/U of Cord CG-55/U (4-foot length) connecting output of Radio Transmitter T-30 ( )/TRC-8 to input of amplifier.</td></tr>
<tr><td>Meter (M1) and Meter switch (S4)</td><td colspan="2">A seven-position selector switch which enables the meter to check the various circuits of the amplifier. Positions and functions are as follows:</td></tr>
<tr><td></td><td>Position</td><td>Function</td></tr>
<tr><td></td><td>1, OFF</td><td>Shorts meter to restrict its movement when amplifier is moved or otherwise handled.</td></tr>
<tr><td></td><td>2, PLATE VOLTS</td><td>Reading is proportional to voltage supplied to the plate of tube V1. Full-scale deflection 1 ma (milliampere) is equal to 2,000 volts.</td></tr>
<tr><td></td><td>3, SCREEN VOLTS</td><td>Reading is proportional to voltage supplied to screen of tube V1. Full-scale deflection is equal to 500 volts.</td></tr>
<tr><td></td><td>4, CATHODE CUR.</td><td>Reading is proportional to cathode current of tube V1. Full-scale deflection is equal to 400 ma.</td></tr>
<tr><td></td><td>5, SCREEN CUR.</td><td>Reading is proportional to screen current of tube V1. Full-scale deflection is equal to 50 ma.</td></tr>
<tr><td></td><td>6, GRID CUR.</td><td>Reading is proportional to grid current of tube V1. Full-scale deflection is equal to 20 ma.</td></tr>
<tr><td></td><td>7, PWR. OUT.</td><td>Reading is proportional to r-f power output. Full-scale deflection is equal to approximately 200 watts.</td></tr>
</table>

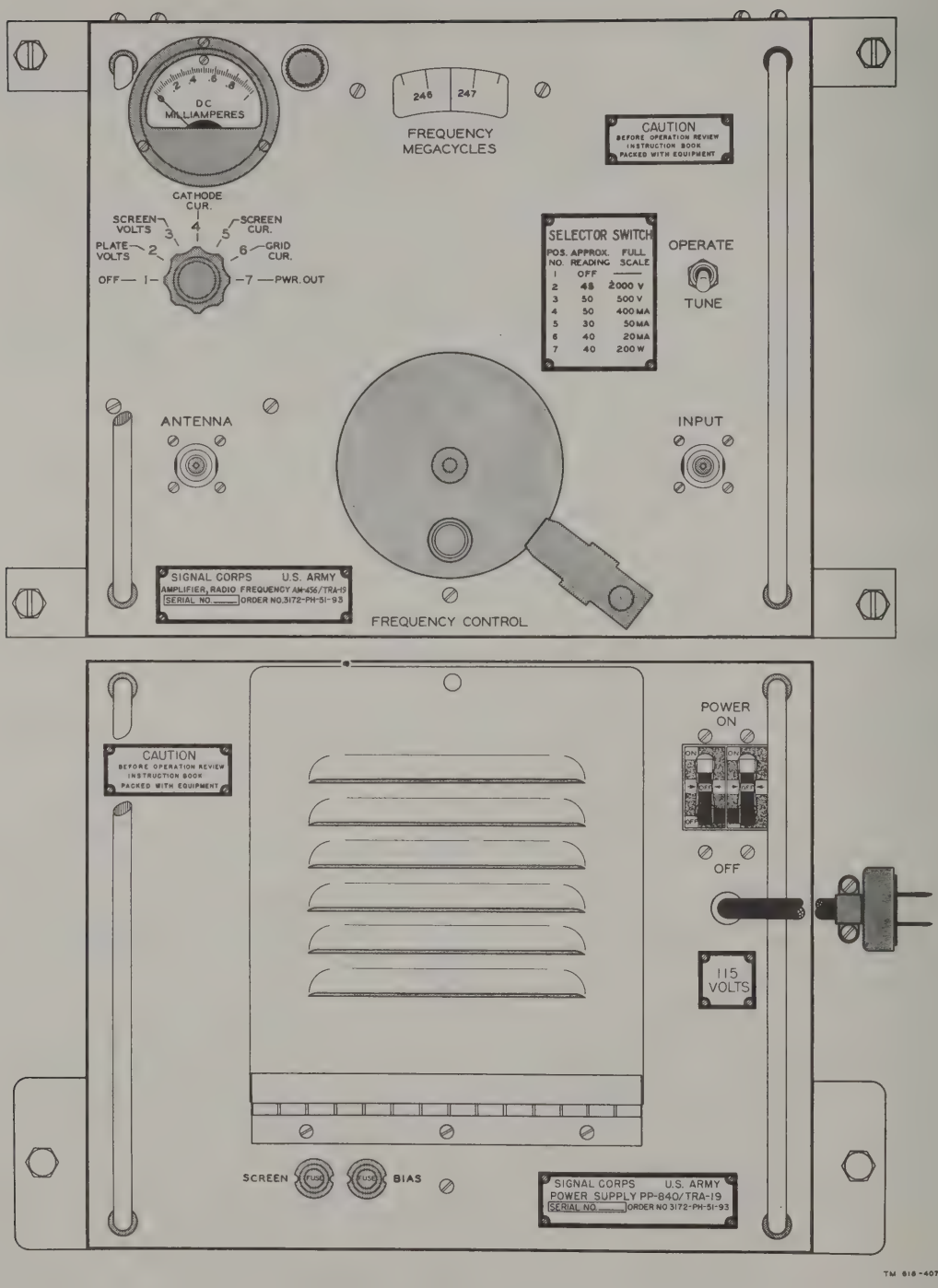


Figure 6. Amplifier-Power Supply Group AN/TRA-19, front panel.

21. Power Supply PP-840/TRA-19 Controls (fig. 6)

The following table lists the controls of the power supply and indicates their functions:

Control	Function
POWER ON-OFF switch (K102 and K103) pilot lamp (I3)	In ON position, switches connect power supply to a-c source and pilot lamp indicates power is available.
Operational switches (S101 and S102) (In back of front panel on top of chassis)	Switches primary windings of transformers (T101 and T102) for operation on a 115-volt or 230-volt power source.
SCREEN and BIAS fuses (F101 and F102)	Accommodates fuses for screen (F101) and grid bias (F102) supply circuits. F101 and F102 are 1/16 amp.

Section III. OPERATION UNDER USUAL CONDITIONS

22. Preliminary Starting Procedure

Perform the following preliminary starting procedure before using the starting procedure described in paragraph 23.

a. Power Unit. Start the power unit according to the instructions given in TM 11-900. Test the output voltage by measuring the a-c voltage across one socket of Junction Box JB-110 with the voltmeter in Multimeter TS-352/U. Regulate the voltage so that it reads between 115 and 120 volts.

b. Power Supply PP-840/TRA-19.

(1) Set POWER ON-OFF switch to OFF.

(2) Check operational switches S101 and S102 (fig. 28). Be sure their settings correspond with the line voltage to be used. Refer to instructions in paragraph 16.

(3) Check tubes and fuses to see that they are seated properly in their sockets.

(4) Plug the 10-foot power cord into Junction Box JB-110.

c. Radio Frequency Amplifier AM-456/TRA-19.

(1) Connect the amplifier as described in paragraph 17.

(2) Set OPERATE-TUNE switch to TUNE.

(3) Turn the meter selector switch to position 3, SCREEN VOLTS.

23. Starting Procedure

Note. If, during the starting procedure, an abnormal result is obtained, see paragraph 43, equipment performance checklist.

a. Throw the POWER ON-OFF switch to ON position. The pilot lamp should light and the blower start. If switch fails to stay up or automatically clicks off, trouble in the equipment is indicated. Refer to the trouble charts (par. 63).

Caution: If the blower does not start, turn off the equipment immediately and find the trouble. Operation of this equipment for even a few minutes without having the blower operate will damage tube V1, type 4X150A.

b. Wait 40 seconds for time-delay relay K101 to close. When the relay closes, meter M1 (in position 3) will indicate one-half scale or less. If the meter reading exceeds one-half scale, turn the equipment off and refer to alinement (par. 67).

c. Aline Radio Transmitter T-30 ( )/TRC-8 for normal operation on its dummy antenna, or on the system antenna with which it is being used, before connecting it to the amplifier input.

d. Release the dial lock and turn the FREQUENCY CONTROL knob on Radio Frequency Amplifier AM-456/TRA-19 until the FREQUENCY MEGACYCLES dial is set to the approximate frequency previously selected on Radio Transmitter T-30( )/TRC-8.

e. Set the meter selector switch to position 7, PWR. OUT. and slowly retune FREQUENCY CONTROL knob for maximum meter reading.

f. Set the OPERATE-TUNE switch to OPERATE. Retune the FREQUENCY CONTROL knob and observe the meter for maximum power output. Readjust the OUTPUT TUNING knob on Radio Transmitter T-30( )/TRC-8 for maximum meter reading on the amplifier in switch position 7.

g. Turn the meter selector switch to all positions and check the meter readings with those shown on the SELECTOR SWITCH. If the readings obtained are not in approximate agreement, refer to the trouble charts (par. 63).

h. Tighten the dial lock.

24. Stopping Procedure

Upon receiving instructions from the control station:

a. Turn the transmitter operation switch to position 1.

b. Turn the transmitter to the off position.

c. Turn the power supply POWER ON-OFF switch to the OFF position.

d. Turn off Power Unit PE-75-AD as instructed in TM 11-900.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

25. General

The operation of this equipment may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of the unusual operating conditions.

26. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the set is not in a heated inclosure, construct an insulated box for the set. Keep the filaments of the vacuum tubes lighted constantly, unless this overtaxes the power supply.

c. Locate the equipment inside a heated inclosure where there is no danger of a cold draft striking the glass tubes when a door is opened. A sudden draft of cold air is often sufficient to shatter the glass envelope of a heated tube. If the inclosure is so constructed that this precaution is impossible, place a blanket or some other barrier between the source of draft and the equipment.

d. When equipment which has been exposed to cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. This condition also arises when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

27. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground or when it is set up in swampy areas, moisture conditions are more acute than normal. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs under the equipment.

28. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of this equipment.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, and dirt which enters the moving parts of radio equipment, such as motors and power units. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with the materials available. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

c. Never tie power cords or other wiring connections to either the inside or outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Be careful to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (ch. 3). Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, and dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

29. Tools and Materials Supplied

The following tools and materials, most of which are included in Tool Equipment TE-113, are needed for the organizational maintenance procedures discussed in paragraphs 39 and 40.

a. TOOLS.

Screw drivers
Wrenches
Pliers
Point file or relay burnishing tool

b. MATERIALS.

Clean cloth
Sandpaper #0000
Crocus cloth
Solvent, Dry Cleaning (SD) (Fed spec No. P-S-661a)

Note. Do not use gasoline as a cleaning fluid for any purpose. Solvent (SD) is available as a cleaning fluid through established supply channels. Carbon tetrachloride will be used, if necessary, only on contact parts of electronic equipment.

30. Special Tools issued for Equipment

a. GENERAL. In addition to the tools described in paragraph 29, certain special tools are required for maintenance and alinement of this equipment. These tools and their use are described in subparagraphs *b* through *f* below.

b. SPANNER WRENCH. A spanner wrench (fig. 7) is furnished with each equipment for the purpose of loosening the plate and grid trimmer locknuts (figs. 34 and 35) to permit adjustments. It is mounted on the bottom of the amplifier chassis.

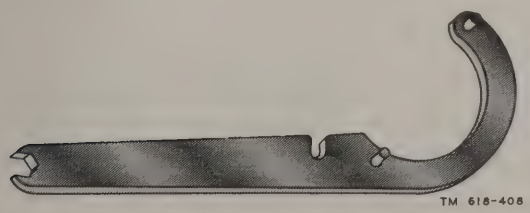


Figure 7. Spanner wrench.

c. ALLEN WRENCH. An Allen wrench (fig. 8) is included with each equipment for the purpose of loosening the Allen-head screws which secure the knobs to the various control shafts. It is mounted on the bottom of the amplifier chassis.

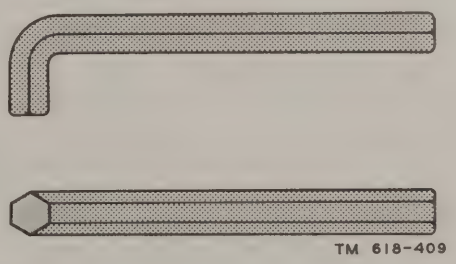


Figure 8. Allen wrench.

d. SHORTING STICK. The shorting stick (fig. 9) may be fabricated by repair personnel as described in subparagraph *e.* below. It is used to discharge capacitors before performing any preventive maintenance or trouble shooting. Normally, when the power in the equipment is turned off, capacitors will discharge to ground through bleeder resistors or voltage dividers. Should a failure occur in a discharging network and the capacitor remain charged, severe burns might result on contact. The use of the shorting stick prevents such accidents.

e. FABRICATION OF SHORTING STICK. Obtain a hardwood dowel which is approximately 1/2 inch in diameter and 15 inches long. Drill a 1/8-inch hole in the end of the dowel, 2 inches deep (fig. 9). Press fit a piece of copper or brass bus wire into the hole, leaving approximately 1 inch of bus wire extending beyond the limits of the dowel. As close to the dowel as possible, solder one end of a 36-inch length of flexible, stranded #10 wire to the bus wire. Attach a battery clamp to the other end of the flexible wire. Apply several layers of friction tape over the soldered connection of the flexible wire and the bus wire, leaving approximately 1/2 inch of bus wire extending untaped. Continue the tape from the soldered connection down over the dowel for a distance of 2 inches from the soldered joint. Apply two layers of rubber tape and two layers of friction tape to the opposite end of the dowel, extending the tape upward 6 inches to form an insulated handle for the shorting stick.

f. USE OF THE SHORTING STICK. Connect the battery clamp to any known chassis ground that may be conveniently located near the capacitor to be discharged. Holding the shorting stick by the insulated handle, touch the exposed bus wire to the capacitor terminals of C102, C103, C104, and C105.

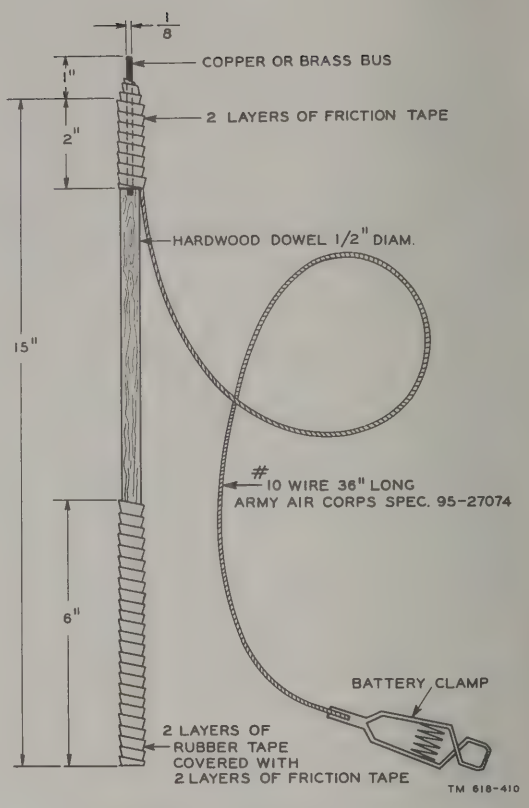


Figure 9. Shorting stick.

Section II. PREVENTIVE MAINTENANCE SERVICES

31. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that break-downs and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See AR-750-5.

32. General Preventive Maintenance Techniques

a. Use #0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques refer to TB SIG 178.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*).							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS.							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.							
6	CHECK FOR NORMAL OPERATION.							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA AGO FORM 1 MAY 51 11-238 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 618-411

Figure 10. DA AGO Form 11-238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE | EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; I Adjustment, repair or replacement required; (I) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	COND.	NO.	ITEM	COND.
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).*		19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES.	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS.		21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.		22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.		23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.	
6	CHECK FOR NORMAL OPERATION.		24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE.	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.		25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.		27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.		31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS.	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.		32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE.	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA AGO FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 16—41382-1

TM 618-412

Figure 11. DA AGO Form 11-239.

33. Use of Preventive Maintenance Forms

(figs. 10 and 11)

a. The information in paragraph 33 is presented as a guide to the individual making an inspection of equipment in accordance with instructions on DA AGO Forms 11-238 and 11-239. The decision as to which items on the forms are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of the second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. The first two columns in the table in paragraph 34 serve as a cross reference between the item numbers of DA AGO Forms 11-238 and 11-239 and the preventive maintenance information in this instruction book. Circled items in figures 10 and 11 are partially or totally applicable to AN/TRA-19.

34. Performing Preventive Maintenance

Perform the following preventive maintenance operations at the intervals indicated, unless these intervals are reduced by a local commander:

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

DA AGO Form 11-238 item No.	DA AGO Form 11-239 item No.	Preventive maintenance operation
		DAILY
1	1	Check for completeness and satisfactory condition of the equipment, including all spare parts and the instruction book (pars. 6.*b.*, 7, and 12).
2	2	Check for suitability of location and installation for normal operation (par. 13).
3	3	Clean dirt and moisture from jacks, plugs, and front panel components (fig. 1).
4	4	Inspect seating of readily accessible *pluck-out* items: tubes, lamps, and connectors (fig. 28).
5	5	Inspect controls for binding, scraping, excessive looseness, and positive action (par. 18.*c.*).
6	6	Check for normal operation.
		WEEKLY
		Note. Disconnect all power before performing the following operations. Discharge high-voltage capacitors with the shorting stick (par. 30.*f.*) or similar tool.
7	7	Clean and tighten exterior of components and cases, rack, coaxial transmission lines, and cable connections (fig. 1).
9	9	Inspect cord, cable, and wire for cuts, breaks, fraying, kinks, deterioration and strain (figs. 4 and 5).
11	11	Inspect canvas items and cabling for mildew, tears, and fraying (fig. 1).
12	12	Inspect for looseness of accessible items: switches, knobs, jacks, connectors, electrical transformers, capacitors, and pilot light assembly (figs. 1, 24, and 28).
14	14	Clean all front panel components (fig. 1).
15	15	Inspect meter for damaged case, glass or movement (par. 51).

34. Performing Preventive Maintenance (contd)

DA AGO Form 11-238 item No.	DA AGO Form 11-239 item No.	Preventive maintenance operations
		MONTHLY
	19	Inspect electron tubes for loose envelopes and cracked bases; clean and dust carefully (fig. 28).
	21	Inspect fixed capacitors for leaks, bulges, and discoloration (figs. 29 and 31).
	24	Inspect resistors, bushings, and insulators for cracks, chipping, blistering, discoloration and moisture (fig. 29).
	25	Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts (fig. 29).
	26	Clean and tighten switches, terminal blocks, and interiors of chassis and cabinets not readily accessible (fig. 31).
	27	Inspect terminal blocks for loose connections, cracks, and breaks (fig. 42).
	29	Lubricate equipment in accordance with applicable Department of The Army lubrication order (par. 35).
	31	Clean and tighten connections and mountings for transformers, chokes, potentiometers, and rheostats (fig. 29).
	32	Inspect transformers, chokes, potentiometers, and rheostats for overheating and leakage (fig. 28).
	37	Check adequacy of moistureproof and fungiproof treatment (par. 37*b*).
	38	If deficiencies noted are not corrected during inspection, indicate what action was taken to correct them.

Section III. LUBRICATION

35. Special Lubrication Instructions

a. Do not use excessive amounts of grease and do not allow connections to become greasy.

b. Be sure that lubricants and points to be lubricated are clean and free from sand, grit, or dirt. Before lubrication, wipe clean all surfaces to be lubricated; use a lint-free cloth dampened with solvent (SD). Keep solvent off surrounding parts.

36. Parts Lubricated by Manufacturer

a. The dial drive assembly and the blower motor are the only components which require lubrication.

b. The points of the dial mechanism which require lubrication are shown in figure 44. Subsequent lubrication will be required at 6-month intervals with low-temperature aircraft grease in accordance with specification No. JAN-G-25.

c. The points of the blower motor which require lubrication are shown in figure 24. Subsequent lubrication will be required at 3-month intervals with Dow Corning DC-550 oil.

d. Gasoline will not be used as a cleaning fluid for any purpose. When the unit is overhauled or repairs are made, parts should be cleaned with solvent (SD).

e. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: on electrical equipment where inflammable solvents cannot be used because of fire hazard and for cleaning relay contacts, plugs, etc.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

Note. Intervals given are maximum for a normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened.

Section IV. WEATHERPROOFING

37. Weatherproofing

a. GENERAL. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. TROPICAL MAINTENANCE. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is fully explained in TB SIG 13, and TB SIG 72.

c. WINTER MAINTENANCE. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained fully in TB SIG 66 and TB SIG 219.

d. DESERT MAINTENANCE. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained fully in TB SIG 75.

e. LUBRICATION. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat. Refer to section III of this chapter for detailed instructions.

38. Rustproofing and Painting

a. When the finish on the case has been scarred or damaged badly, rust and corrosion can be prevented by touching up bared surfaces. Use #00 or #000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

Section V. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

39. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is limited necessarily in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. Paragraphs 40 through 43 help in determining which of the components, such as the power supply or amplifier, are at fault. In addition, troubles in any component will be localized (to a limited extent only) to the particular defective stage or item.

c. Complete trouble localization procedures and the necessary follow-up repairs are discussed in Chapter 5, sections II and III.

40. Visual Inspection

a. Failure of this equipment to operate properly will usually be caused by one or more of the following faults:

(1) Improperly connected cables.
(2) Worn, broken, or disconnected cords or plugs.
(3) Burned-out fuses.
(4) Broken wires.
(5) Defective crystal.
(6) Defective tubes.

b. Check the antenna for proper orientation and polarization.

c. When failure is encountered and the cause is not immediately apparent, check as many of the items given in subparagraphs *a* and *b* above as is practicable, before starting a detailed examination of the component parts of the system.

d. It is helpful to have a record of the normal performance data of the equipment when looking for the source of trouble. If such a record is not available, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

41. System Sectionalization

a. GENERAL. System sectionalization of Radio Set AN/TRC-8 ( ), Radio Terminal Set AN/TRC-11 ( ), and Radio Relay Set AN/TRC-12 ( ) is covered thoroughly in the instruction book for these equipments. The addition of Amplifier-Power Supply Group AN/TRA-19 to these systems does not alter the performance of system components, such as the transmitter or receiver. If the r-f power output is not available and Radio Transmitter T-30 ( )/TRC-8 is found to be operating properly, the trouble obviously will be found in Radio Frequency Amplifier AM-456/TRA-19, Power Supply PP-840/TRA-19, or in the interconnecting cables. The system sectionalization chart contained in this instruction book will assist in isolating trouble to the major components of Amplifier-Power Supply Group AN/TRA-19. Use it with the similar chart contained in the AN/TRC-8 ( ) instruction book.

b. SYSTEM SECTIONALIZATION. System sectionalization consists of tracing faults to the component responsible for abnormal operation of the sets.

(1) Careful observation of the equipment while turning it on often sectionalizes the fault to the amplifier or power supply. See the equipment performance checklist (par. 43) for normal operating conditions.

(2) Check fuses at an early stage in trouble shooting. Do not continue to burn out fuses before looking elsewhere to determine the basic source of trouble.

(3) Whenever possible, replace defective units with units known to be good. If the trouble disappears, the replaced unit is definitely at fault.

(4) For localizing trouble, perform the steps given in the table below in sequence. The chart lists methods of correction after a complete system break-down. By proper use of this chart, time can be saved that might otherwise be lost in checking components that are free of trouble.

Symptom	Probable Trouble	Remedy
1. Equipment dead. Pilot light out.	1. Tripped circuit breakers.	1. Reset circuit breakers.
	Equipment operating on 115 volts but set for operation on 230 volts.	Set equipment for 115-volt operation.
	Power cord defective.	Repair or replace.
	Poor connection into junction Box JB-110.	Repair.
	Interlock switches defective.	Repair or replace.
2. Equipment inoperative. Pilot light on.	2. Interconnecting cables improperly connected or not making good contact.	2. Check interconnecting cables and tighten connectors.
	Controls improperly set for operation.	Check control settings and reset if necessary.
	Time-delay relay defective.	Replace.
	Defective tubes.	Replace defective tubes.
3. No r-f output. Meter readings normal.	3. Cord CG-55/U open or shorted.	3. Replace or repair.

42. Trouble Shooting by Using Equipment Performance Checklist

a. GENERAL. The equipment performance checklist (par. 43) will help the operator to determine whether the equipment is operating properly. The list gives the item to be checked, the conditions under which it is checked, the normal indications and tolerances of correct operation, and the measures required to correct any abnormal conditions. The checks given include preoperational, operational, and stopping checks. *To use this list, follow the items in numerical sequence.*

b. ACTION OR CONDITION. For some items, this column consists of the switch and control settings required to check the proper operation of the equipment. For other items, this column gives actions, such as connecting the antenna or tuning a transmitter, that must be taken to check the results given in the normal indications column.

c. NORMAL INDICATIONS. The normal indications include the visible signs that the operator will perceive when the items are checked. In the case of meter readings, limits are given between which operations may be considered satisfactory. A meter reading outside the given limits is a sign of trouble. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those that the operator can make without turning the equipment in for repairs. Where repairs cannot be made at the organizational maintenance level but require trouble shooting by an experienced repairman, reference is made in the table to Chapter 5. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communications be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

43. Equipment Performance Checklist

a. ITEMS 1 THROUGH 6. These items, included under PREPARATORY, should be checked before starting each time the equipment is put into operation.

b. ITEMS 7 THROUGH 12. These items, included under START, show all actions taken during starting procedure.

c. ITEM 13. This item, included under EQUIPMENT PERFORMANCE, shows meter readings which are made while the equipment is in operation. Readings should be checked at least once during a normal operating period or at least four times a day during continuous operation. Meter readings are correct for input voltages of 115 or 230 volts. If input voltage exceeds these values, slightly higher readings may be expected. Meter readings should be recorded and studied daily, since any change in normal readings is an indication of a fault which may develop into a break-down. The operator must become familiar with the characteristics of the equipment during normal operation; he must use this knowledge as a basis for recognizing changes in audible and visible indications, such as relay clicks and meter readings, when the set is not operating properly.

d. ITEM 14. This item shows the STOP procedure. After following the stopping procedure for Amplifier-Power Supply Group AN/TRA-19, refer to the instruction book covering AN/TRC-8( ), AN/TRC-11( ), and AN/TRC-12( ) equipments for stopping procedure on the complete system.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Power Unit PE-75-AD.	Running Cord CD-711 or Junction Box J-85/G connected.	Output 115 volts ac.	See TM 11-900.
	2	Radio Transmitter T-30 ( )/TRC-8.	Connected and operating as shown in instruction book for AN/TRC-8 ( ) equipment.		See instruction book for AN/TRC-8 ( ) equipment.
	3	Amplifier-Power Supply Group AN/TRA-19 (10-ft cord).	Plugged into Junction Box JB-110.		
	4	Cord CG-55/U (4-ft length).	Connected from ANTENNA receptacle on Radio Transmitter T-30 ( )/TRC-8 to INPUT receptacle on Amplifier-Power Supply Group AN/TRA-19.		
	5	Cord CG-55/U (60-ft length) removed from ANTENNA receptacle on Radio Transmitter T-30 ( )/TRC-8.	Plugged into ANTENNA receptacle on Amplifier-Power Supply Group AN/TRA-19.		
	6	Antenna Assembly AS-52 ( )/TRC-8.			

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	7	Radio Transmitter T-30 ( )/TRC-8.	Set for operation as described in instruction book for AN/TRC-8 ( ) equipment.		See instruction book for AN/TRC-8 ( ) equipment.
	8	Operation switches.	Set for 115- or 230-volt operation.		
	9	POWER ON-OFF switch.	Throw to ON.	Pilot lamp lights. Blower operates.	Check power cords. Check circuit breakers.
	10	FREQUENCY CONTROL knob.	Adjust to correspond with frequency setting of Radio Transmitter T-30 ( )/TRC-8.	Meter reading.	Check r-f cords. Refer to Chapter 5.
	11	OPERATE-TUNE switch.	Set to OPERATE. Retune FREQUENCY CONTROL knob.	Adjust for maximum meter reading (pos. No. 7).	Refer to Chapter 5.
	12	Radio Transmitter T-30 ( )/TRC-8.	Readjust OUTPUT TUNING.	Maximum meter reading.	Refer to instruction meter reading (Pos. book for AN/TRC-8 ( ) equipment.
EQUIPMENT PERFORMANCE	13	Meter Readings.	Meter switch position:		
			1 OFF	Meter reads zero	
			2 PLATE VOLTS	.40 - .50	Check tubes V102 and V103.
			3 SCREEN VOLTS	.40 - .55	Check tubes V101, V104, V105, and V106.
			4 CATHODE CUR.	.40 - .60	Check tubes V101 and V1.
			5 SCREEN CUR.	.20 - .40	Check tubes V101, V104, V105, V106, and V1.
			6 GRID CUR.	.20 - .60	Check tube V1.
			7 PWR. OUT.	.30 - .70	Check tube V1. Refer to chapter 5. Check CR1.
STOP	14	POWER ON-OFF switch.	Throw to OFF position.	Pilot lamp goes out. Blower stops.	

CHAPTER 4

THEORY

Section I. THEORY OF RADIO FREQUENCY AMPLIFIER AM-456/TRA-19

44. Block Diagram (fig. 12)

Radio Frequency Amplifier AM-456/TRA-19 is a tuned amplifier covering a frequency range of 230 to 250 mc. Tuning is accomplished by means of coaxial cavities with nonshorting plungers. A power input of 5 watts is amplified to a power output of 75 watts with a single type 4X150A tetrode tube (V1). The signal path of the amplifier is shown in the block diagram (fig. 12). A complete schematic diagram is shown in figure 40.

a. BLOWER. A motor-driven blower is contained in the amplifier for the purpose of forcing air through the cavity to maintain adequate cooling of amplifier tube V1.

b. LOW-PASS FILTER. Low-pass filter Z1 affords a means of reducing the r-f harmonic distortion of the power output of the cavity.

c. DIRECTIONAL COUPLER. Directional coupler DC1, mounted in the low-pass filter, samples the energy flowing to the antenna and thus establishes a means of monitoring the r-f power output.

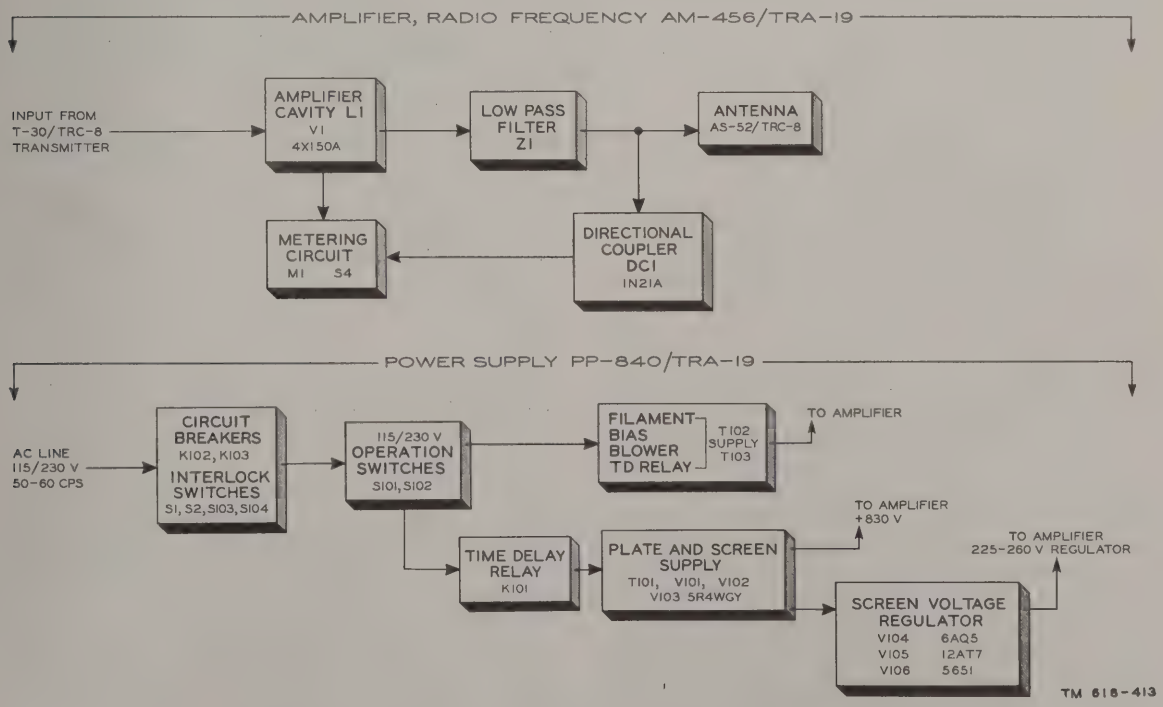
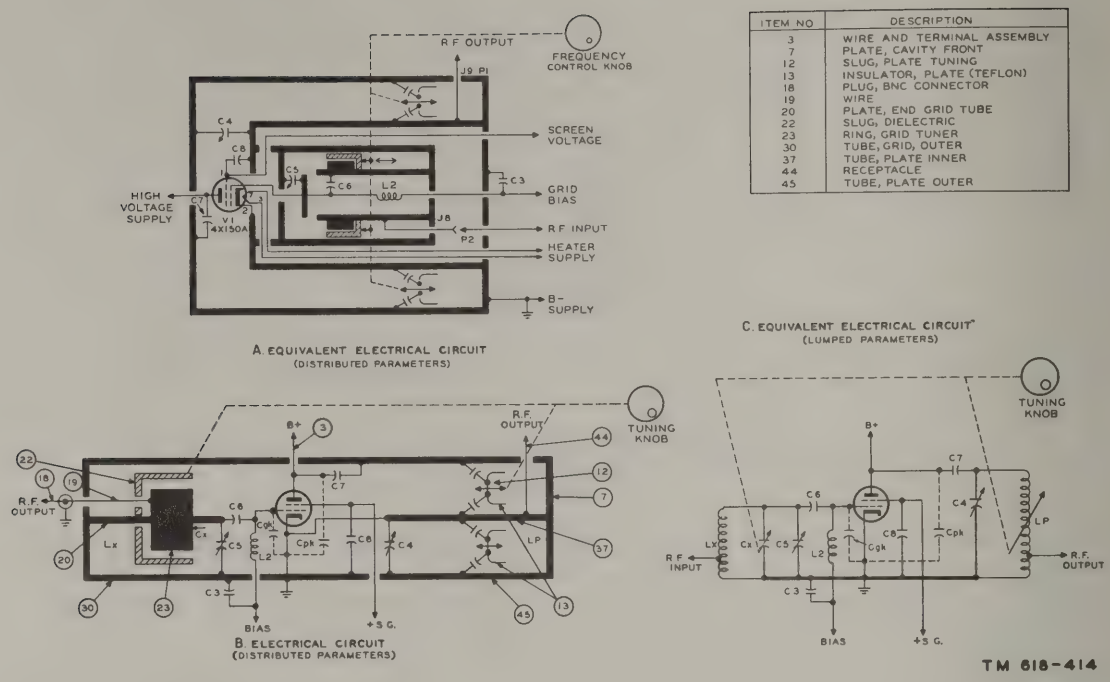


Figure 12. Block diagram, Amplifier-Power Supply Group AN/TRA-19.



ITEM NO	DESCRIPTION
3	WIRE AND TERMINAL ASSEMBLY
7	PLATE, CAVITY FRONT
12	SLUG, PLATE TUNING
13	INSULATOR, PLATE (TEFLON)
18	PLUG, BNC CONNECTOR
19	WIRE
20	PLATE, END GRID TUBE
22	SLUG, DIELECTRIC
23	RING, GRID TUNER
30	TUBE, GRID, OUTER
37	TUBE, PLATE INNER
44	RECEPTACLE
45	TUBE, PLATE OUTER

Figure 13. Amplifier cavity, schematic diagram.

d. METER AND SELECTOR SWITCH. Meter M1 and selector switch S4 are furnished for monitoring voltages and current in various portions of the circuit.

45. Mechanical Description of Cavity
(figs. 13 and 39)

a. The cavity furnishes the following:
(1) Mechanical support for amplifier tube V1 (4X150A).
(2) Means of tuning the input and output circuits of the tube.
(3) Means for conveying forced air necessary to cool the tube.

b. The tuned input circuit consists of the concentric transmission line formed by items 20 and 30. Tuning is accomplished by moving the dielectric slug, item 22, with rods, item 21, along the brass slug, item 23. The lead screw, item 24, allows for rotating the grid trimmer adjustment, item 29. Items 25 and 26 form the grid choke. Items 27 and 28, in conjunction with item 20, form the grid blocking capacitator. R-f input is conveyed via the connector, item 18, and the conductor, item 19, contacting the brass slug, item 23. Item 30 assembles to the tube socket, item 34, which is supported by item 37, the output circuit inner tube. Item 29 contacts item 33, the grid socket contact spring. The grid trimmer knob, item 2, fastens on the end of item 24 and allows adjustment of the grid trimmer after the locknuts have been loosened.

c. The output circuit consists of a concentric transmission line formed by item 37, the inner tube, and item 45, the outer tube. One end of this concentric transmission line is short-circuited by item 7, the cavity front plate. Item 49, the rear cavity plate, is fastened to the other end of the outer tube, item 45, and provides means for supporting tube V1 (4X150A). Item 46, the capacitor ring, and item 47, the capacitor dielectric, are fastened to item 49, the cavity rear plate. This assembly forms the plate circuit blocking capacitor. Item 48, the plate contact spring, contacts the anode of the 4X150A tube and is fastened to item 46, the plate circuit inner capacitor ring.

d. The plate circuit is tuned by item 12, the plate tuning slug. Teflon rings, item 13, prevents the tuning slug from contacting the concentric line. The slug is moved by nylon rods, item 14. Item 50 supports item 51, the rotor of the plate trimmer capacitor. Item 42 and 43 form the stator of this capacitor. R-f output from the amplifier is taken by a probe which is connected to the receptacle, item 44. Single knob tuning control is accomplished by ganging the plate tuning rods, item 14, and the grid tuning rods, item 21, to the rod connecting plate, item 1. Cooling of the 4X150A tube is accomplished by forcing air into a duct through the cavity front plate, item 7, and through a channel within the

cavity formed by items 30 and 37. A neoprene gasket, item 9, seals the wire and cable entry into the cavity so that air is forced through the cavity, through the tube socket, item 34, through the chimney, item 38, through the anode of V1, the 4X150A, and out through holes in the end cap, item 52.

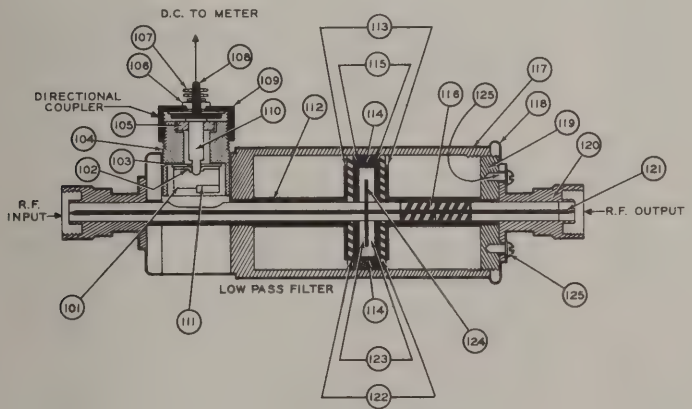
46. Electrical Description of Cavity
(A, fig. 13)

a. A, figure 13 is a simplified electrical equivalent diagram of the cavity L1. B, figure 13 was derived by illustrating the plate cavity on one side of the tube, and the grid cavity on the other side, showing distributed parameters. C, figure 13 shows the electrical equivalent of B, figure 13 using lumped electrical parameters.

b. The basic design has incorporated tuning of the grid input circuit and plate output circuit of tube V1 (4X150A). Tuning is accomplished by different methods in the grid and plate circuits.

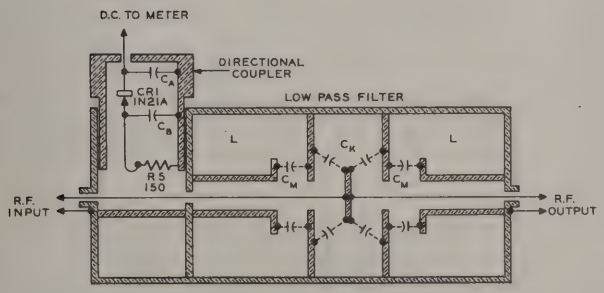
c. The grid input circuit (B, fig. 13) is a parallel resonant circuit in which the inductive portion consists of Lx, and the capacitive portion consists of Cx, C5, and the interelectrode capacitance of V1, Cgk. These capacitors are connected in parallel and serve to resonate inductor Lx. The capacitive reactance of the grid blocking capacitor C6 does not appreciably affect the tuning of this parallel resonant circuit. The impedance of r-f choke L2 does not cause appreciable detuning of the resonant circuit. Capacitor C3 serves as an r-f bypass for the bias lead.

d. B, figure 13 shows the inductive portion of the circuit Lx, which is formed by those portions of items 20 and 30 to the left of item 23. Variable capacitor Cx is formed by the close spacing of items 23 and 30. The value of capacitance is varied by moving the dielectric slug, item 22, in and out of the space between items 23 and 30. The r-f input is brought into the cavity through a connector, item 18, and is connected to a 50-ohm point within the cavity by means of the wire, item 19. Tapping at the 50-ohm point provides for maximum transfer of power from Radio Transmitter T-30 ( )/TRC-8 to the input circuit of the amplifier.

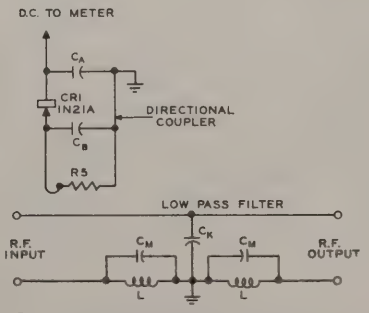


A. LONGITUDINAL CROSS SECTION

ITEM NO.	DESCRIPTION
101	COUPLER PICKUP PROBE
102	COUPLER CAPACITOR PLATE
103	COUPLER HOUSING INSULATOR
104	COUPLER HOUSING
105	COUPLER INSULATOR BUSHING
106	COUPLER INSULATOR BUSHING
107	COUPLER HEX NUT
108	COUPLER CAPACITOR PLATE
109	COUPLER HOUSING CAP
110	COUPLER CRYSTAL IN21A
111	COUPLER RESISTOR
112	FILTER TRANSMISSION LINE (OUTER)
113	FILTER OUTER DISK (METAL)
114	FILTER RING (METAL)
115	FILTER INNER DISK (METAL)
116	FILTER DIELECTRIC SPACERS
117	FILTER OUTER TUBE
118	FILTER JAM NUT
119	FILTER END PLATE
120	FILTER CONNECTOR
121	FILTER TRANSMISSION LINE (INNER)
122	FILTER DIELECTRIC DISC (OUTER)
123	FILTER DIELECTRIC DISC (INNER)
124	FILTER CENTER DISC (METAL)
125	FILTER MACHINE SCREW



B. ELECTRICAL CIRCUIT (DISTRIBUTED PARAMETERS)



C. EQUIVALENT ELECTRICAL CIRCUIT (LUMPED PARAMETERS)

TM 618-415

Figure 14. Low-pass filter and directional coupler, schematic diagram.

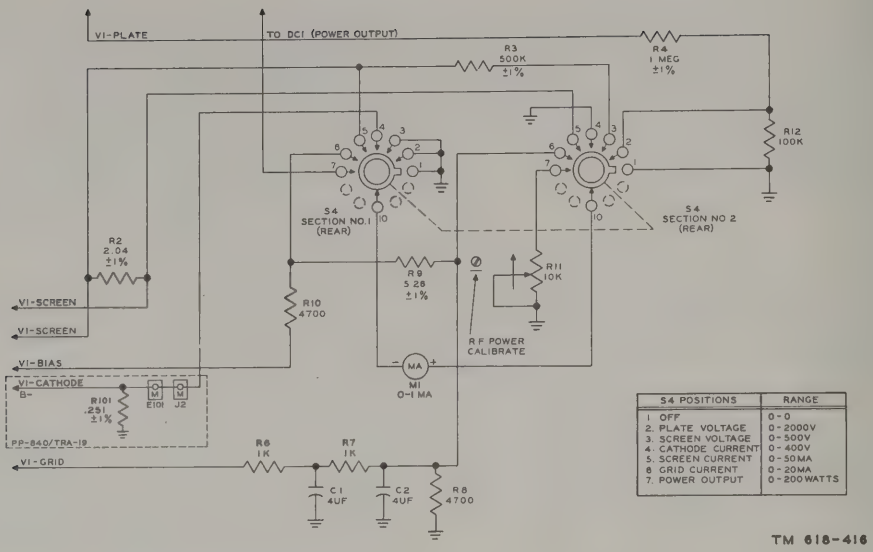


Figure 15. Metering circuit, schematic diagram.

e. The output circuit consists of the inductor Lp, parallel resonated by capacitor C4 and the interelectrode capacitance of V1, Cpk. The capacitive reactance of blocking capacitor C7 does not affect appreciably the resonant frequency of the tube output circuit. The high-voltage lead, item 3, connected to the anode of V1 has sufficient inductance at high-frequency operation to serve effectively as an r-f choke.

f. The inductive portion of the circuit Lp is formed by the concentric line consisting of items 37 and 45 short-circuited at the far end by item 7.

g. Moving the capacitor slug, item 12, along the transmission line effectively varies the magnitude of Lp.

h. The cavity has been designed so that equal movement of items 12 and 22 provide for equal frequency change in the plate output circuit and the grid input circuit, respectively. Tracking is accomplished by properly alining trimmer capacitors C4 and C5. Capacitor C8 grounds the screen grid circuit of tube V1, 4X150A. This capacitor is an integral part of tube socket X1 (4X150A/4000). R-f output from the cavity is taken from receptacle, item 44, which is connected within the cavity to a 50-ohm point in the output resonant circuit. This provides for a proper impedance match to the 50-ohm antenna feed line, Cord CG-55/U (60 feet).

47. Mechanical Description of Low-Pass Filter (Z1)

a. A, figure 14 shows the longitudinal cross section of the filter Z1 and directional coupler DC1. B, figure 14 shows the electrical circuit diagram of the filter and directional coupler in terms of distributed parameters. C, figure 14 shows the equivalent electric circuit diagram with lumped parameters.

b. The filter is constructed around a concentric transmission line consisting of items 112 and 121. Dielectric spacers, item 116, separate the inner and outer conductors of the transmission line.

c. The transmission line is broken at the center to form the basic filter elements. These filter elements consist of five metal discs, items 113, 115, and 124, which are separated by four dielectric discs, items 122 and 123. The metal ring, item 114, is a supporting member for two metal discs, item 115. The outer tube, item 117, forms a supporting member for these filter elements and completes the electrical circuit.

d. The filter is factory-tuned to frequency by manually adjusting the end plate, item 119, and its associated disc, item 113, by rotating connector, item 120. The jamnut, item 118, is tightened to hold the end plate in place. A spanner wrench is provided for this purpose. Items 120 are specially manufactured type N coaxial connectors, secured at each end of the filter with screws, item 125.

48. Electrical Description of Low-Pass Filter

a. The electrical description can best be illustrated by referring to B, figure 14 and its lumped parameter equivalent, C, figure 14. The filter is electrically symmetrical on either side of the disk attached to item 121. Inductive section L is formed by a short section of the transmission line, short-circuited at one end. Capacity Cm is formed

by parallel disks closely spaced. Cm is parallel resonant with inductor L at the second harmonic frequency of the amplifier, and thus presents a high impedance to prevent passage of the second harmonic content.

b. Ck is a capacitance formed from the center conductor to ground by closely spaced discs. This capacitance forms a low-impedance path to ground for the second harmonic content of the amplifier, and thus helps to reduce the second harmonic content.

c. Basically, this filter consists electrically of two *m* derived half-sections in which *m* equals .55 and the resonant frequency equals 480 mc.

49. Mechanical Description of Directional Coupler (fig. 14)

The directional coupler consists of a type 1N21A crystal, item 110, and its pick-up loop, item 101, housed in a mechanical assembly consisting of items 104 and 109. The directional coupler is housed in a cylindrical opening at one end of the filter. Items 102 and 104 form bypass capacitor Cb. Items 108 and 109 form bypass capacitor Ca. Item 108 is threaded at the top to allow connection of the output wire by nuts, item 107. Item 106 is a dielectric spacer. Item 105 is a dielectric spacer supporting the crystal, item 110. Item 111 is a resistor (R5) which is connected to the probe, item 124.

50. Electrical Description of Directional Coupler

Item 112 of the low-pass filter, which is the outer conductor of the 50-ohm coaxial transmission line, is slotted below the directional coupler to allow the pick-up probe, item 101, to be excited by the r-f field. Resistor R5, item 111, and capacitor Cb form an electrical path through which r-f energy picked up on the probe, item 124, is allowed to circulate. The 1N21A crystal rectifies some of this r-f voltage, and energy is stored by capacitor Ca which is charged to a d-c voltage proportional to the amount of r-f energy flowing through the filter to the antenna. The directional coupler and, particularly, the pick-up probe, item 101, have been so designed that r-f energy flowing to the antenna will be registered; however, any energy reflected from the antenna because of mismatch will not be indicated by the directional coupler.

51. Metering Circuits (fig. 15)

Meter M1 (0-1 ma) is provided on the front panel of Radio Frequency Amplifier AM-456/TRA-19 for checking operation of the various circuits of the amplifier and power supply. Meter switch S4 also on the front panel, connects the meter to check the desired function. The range of the meter for each switch position is shown in the table in figure 15.

a. OFF POSITION. In this position, both sides of the meter are connected to ground, short-circuiting the meter to prevent damage to the movement when the amplifier is being transported.

b. PLATE VOLTS POSITION. In this position, the negative terminal of the meter is grounded, and the positive terminal of the meter is returned through R4 (1 meg (megohm) ± 1%) to the high-voltage supply. Resistor R12 (100K ohms) is connected in parallel to reduce the current through the meter. Current will flow from the high-voltage supply through R4 and through the meter in proportion to the high voltage present.

c. SCREEN VOLTS POSITION. In this position, the negative terminal of the meter is grounded, and the positive terminal of the meter is returned through resistor R3 (500K ±1%) to the screen voltage supply. Current will flow through the meter proportional to the screen voltage present.

d. CATHODE CUR. POSITION. In this position, the positive terminal of the meter is grounded, and the negative terminal of the meter is returned to pin M of jack J2 which is carried through cable W101 to terminal board E101 and Power Supply PP-840/TRA-19. From pin M of E101, the return is carried to R101 which is in series with the return from the center tap of the high-voltage transformer to ground. R101 shunts the meter to cause the proper current to flow through it.

e. SCREEN CUR. POSITION. In this position, the meter is connected across resistor R2 (2.04 ohms ±1%) which carries the screen current of amplifier tube V1 (4X150A). Resistor R1 (33K) is inserted in series with the screen grid to allow proper tune-up of the amplifier without damage to the amplifier tube.

f. GRID CUR. POSITION. In this position, the meter is connected across resistor R9 (5.26 ohms ±1%) which carries the grid current of the amplifier. Resistor R10 (4,700 ohms) provides additional grid bias when the amplifier is in operation.

g. PWR. OUT. POSITION. In this position, the negative lead of the meter is connected to the directional coupler. The positive terminal of the meter is returned to ground through potentiometer R11 (10K) which allows proper setting of the meter indication so that the r-f power output may be read directly.

52. Operate-Tune Switch

a. OPERATE-TUNE switch, S3, is located on the front panel. In the TUNE position, the screen-grid voltage of amplifier tube V1 is decreased by inserting a resistance, R1 (33K), in series with the screen-grid lead.

b. R13 (100K) is a bleeder resistor from the screen grid of amplifier tube V1 to ground, used to stabilize screen voltage when switch S3 is in the TUNE position.

c. Reducing the screen-grid voltage will reduce the cathode current drawn by the tube, thereby reducing both plate dissipation and r-f power output. This allows tune-up without damage to the amplifier tube because of excess plate dissipation. The switch is thrown to the OPERATE position after tune-up when the equipment is to operate as part of the communication system.

Section II. THEORY OF POWER SUPPLY PP-840/TRA-19

53. Block Diagram
(fig. 12)

a. Power Supply PP-840/TRA-19. The PP-840/TRA-19 provides all necessary voltages for the operation of Radio Frequency Amplifier AM-456/TRA-19. Power from the a-c line, either 115 or 230 volts, 50 to 60 cycles per second, is fed through circuit breaker K102 and K103, and through interlock switches S1, S2, S103, and S104 to the 115- or 230-volt operation switches. These switches are set for the proper input voltage, and power is supplied to the filament circuits, the bias circuit, the blower, and to the time-delay relay. Time-delay relay K101 permits the heater of tube V1 to warm up for a period of 40 seconds before the screen and anode voltages are applied. This delay prevents damage to the 4X150A tube (V1). For additional safety, all operating voltages are applied through relay K101.

b. Time-Delay Relay and Interlock Switches (fig. 16)

(1) Power is taken from the a-c line through a 10-foot power cord terminated by plug P103. The front panel circuit breaker and power switch combination, K102 and K103 turn the equipment ON or OFF as desired. These switches are mounted together, one for each power lead, so they can be actuated simultaneously when starting or stopping the equipment. The circuit breakers are designed to turn off the equipment automatically when a load greater than 4.5 amperes is drawn from the line.

(2) As a safety measure, to prevent dangerous high-voltage shocks, both sides of the a-c line are fed through interlock switches S103 and S104, located on the rear of the power supply chassis. From the interlock

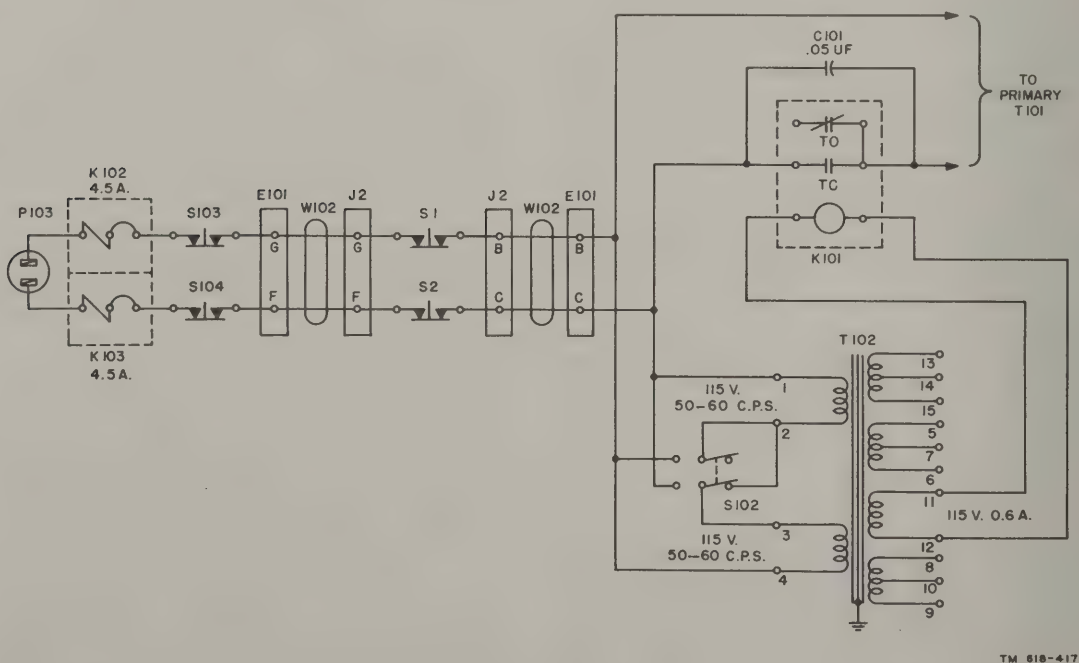


Figure 16. Time-delay relay and interlock switches, schematic diagram.

switches, the ac is brought to terminal board E101 and terminates in connector P102 through cable W102.

(3) The interlock switches in the amplifier, S1 and S2, located on the rear of the amplifier chassis, complete a circuit back to terminals B and C of connector J2 and from there through cable W102 to terminal board E101. If any of the four interlock switches do not make contact, the equipment cannot operate. The voltage available at terminal B and C of terminal board E101 is fed simultaneously to the primary of transformer T102, through switch S102, and to the open contacts of the time-delay relay K101. In figure 17 switch S102 is shown in the 230-volt position. One of the secondary windings of transformer T102 is wound to give 115 volts at .6 ampere for either 115-volt or 230-volt input voltage. This voltage is fed to blower motor B1 and to a motor in relay K101. This motor causes the contacts of the relay to close in 40 seconds. Capacitor C101 (.05 uf (microfarad)) bypasses the contacts of relay K101 to minimize arcing on make or break. Interlock shorting switches (figs. 25 and 29) are available on the rear of both chassis to restore voltage when the equipment is being serviced outside the case.

c. 115- OR 230-VOLT LINE SWITCHES (fig. 17). Either 115- or 230-volt excitation is provided at terminals B and C of terminal board E101 as described in subparagraph b above. Transformers T101 and T102 are provided with twin primary windings to permit operation from either supply. For 115-volt operation, the twin windings are operated in parallel, and for 230-volt operation, the transformer primary windings are operated in series. Switching is accomplished by switches S101 and S102. In figure 17, the switches are shown in the 230-volt position.

d. HIGH-VOLTAGE RECTIFIER CIRCUIT (fig. 18). Voltage is fed to the primary of transformer T102. One of the secondaries provides an output voltage of 5 volts at 4 amperes used to heat the filaments of high-voltage rectifiers V102 and V103 (5R4WGY). After a 40-second time delay, voltage is applied to the primary of transformer T101 which applies an rms (root mean square) output voltage of 800 volts each side of center tap to the anodes of the rectifier tubes. Two tubes are used because the load is too great for one tube. One half of each tube is used on each side of the transformer to balance the wear on these tubes. Output high voltage

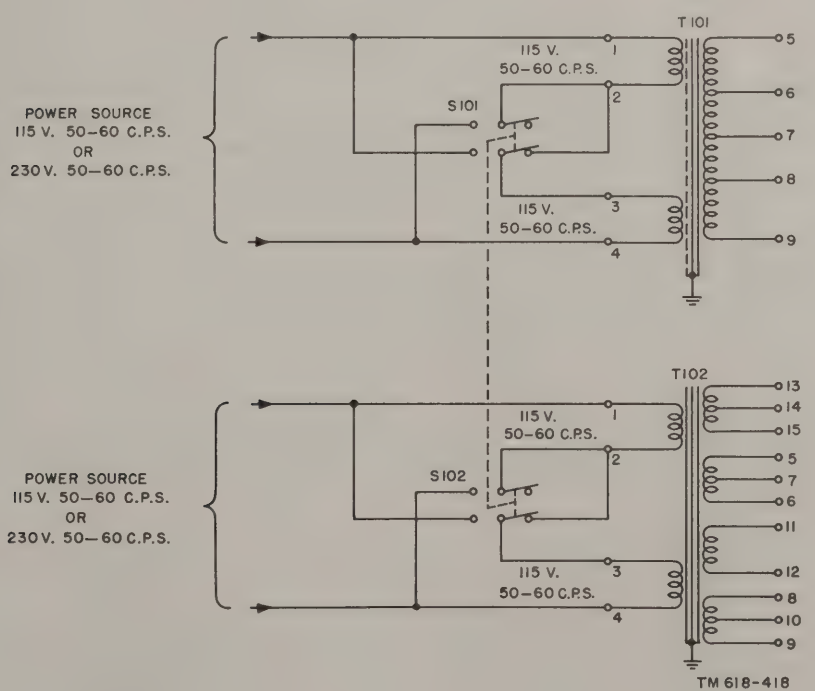


Figure 17. 115- or 230-volt line switches, schematic diagram.

appearing at the center tap of the filament winding on transformer T102 is pulsating dc (direct current) and is filtered to pure dc by a filter network composed of L101 (10 h (henrys)) and capacitors C102 and C103 (4 uf). Resistor R102 (56K) is the bleeder resistor used to improve the regulation of the high-voltage power supply and to discharge the filter capacitors. Resistor R101 (.251 ohm ± 1%) is in the path of the cathode current of V1, 4X150A tube, and is used for metering. High voltage is taken from the power supply to the amplifier through cable W101 and connector P101.

54. Low-voltage Rectifier Circuit (fig. 19)

a. Transformer T102 is provided with a 5-volt, 2-ampere winding used to heat the filament of the low-voltage rectifier tube V101 (5R4WGY). Transformer T101 is provided with 380-volt taps each side of center. The windings of the transformer are designed so that 40 ma may be drawn from these taps. These taps are connected to the plates of V101.

b. Pulsating dc appears at the center tap of the filament winding on transformer T102 and is smoothed to pure dc by the filter network composed of L102 (10 h) and capacitors C104 and C105 (4uf each). Resistor R103 (100K) is provided to discharge the filter capacitors and thereby remove shock hazards. Resistor R101 is the cathode current meter shunt. Fuse F101 (1/16 ampere, 250 volts) is provided to protect the equipment in case of overload in the screen-grid circuit.

55. Screen Voltage Regulator Circuit (fig. 20)

The output of the low-voltage rectifier circuit is fed from fuse F101 to the plate of voltage regulator tube V104 (6AQ5), represented on figure 20 as terminal A. The operation of this circuit can be described best by assuming that the voltage at terminal A increases. Since an electron tube may be considered as a variable resistance, with the resistance depending on the voltage existing between cathode and grid, the voltage at terminal B will increase with an increase in the voltage at terminal A. Resistors R106 (22K), R111 (11K), and R112 (3,500 ohms variable) form a voltage-divider network. When the voltage at terminal B increases, the voltage on the cathode of V105A (pin 3) also will increase. A

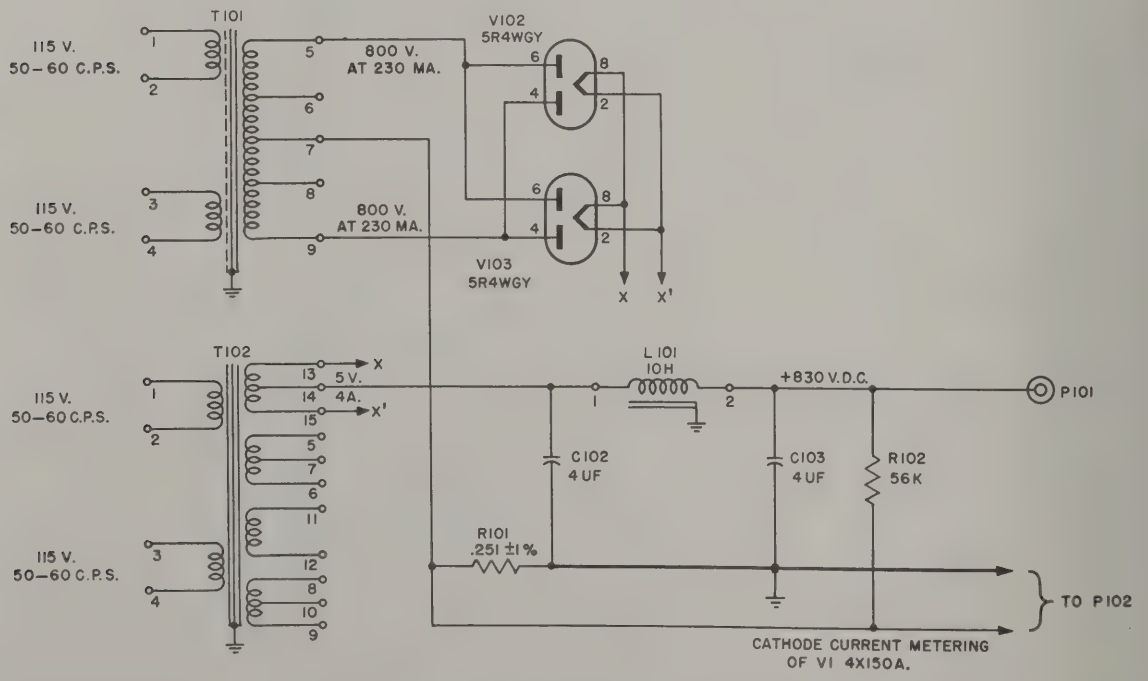


Figure 18. High-voltage rectifier, schematic diagram.

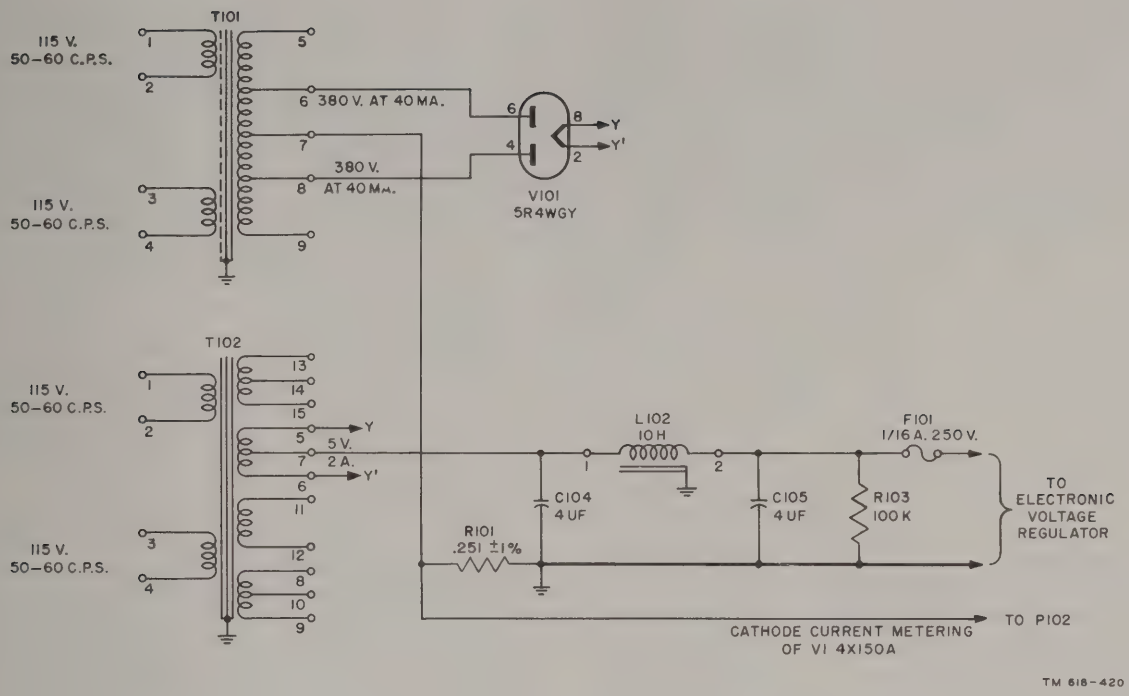


Figure 19. Low-voltage rectifier, schematic diagram.

constant voltage is maintained on the grid (pin 2) of V105A by voltage reference tube V106 (5651) in series with resistor R107 (120K). Resistor R109 (1 meg) isolates the grid of V105A. Since the voltage on the grid of V105A (pin 2) is constant, the increase in positive voltage on the cathode (pin 3) represents an increase in grid bias; therefore, the current through V105A will decrease. Resistor R105 (470K) is the plate load resistor. The decreased plate current through V105A will cause less of a voltage drop across R105 and, therefore, the voltage on the plate of V105A (pin 1) will become more positive than in the original condition. The grid of V105B (pin 7) is connected directly to the plate of V105A; therefore, the potential on the grid of V105B will be exactly the same as the potential on the plate of V105A. Resistors R108 (22K) and R110 (33K) form a voltage-divider network, maintaining practically a constant voltage on the cathode (pin 8) of V105B. Since the cathode voltage is held practically constant, the increase in the positive direction of the grid voltage applied from the plate of V105A will cause V105A to draw a higher plate current. Resistor R104 (470K) is the plate load resistor for V105B. Since the plate current of V105B has increased, there will be a greater voltage drop across R104 and, therefore, a decrease in the positive voltage on the plate of V105B (pin 6). The grid of voltage regulator tube V104 (6AQ5) is connected directly to the plate of V105B. When the positive voltage on the plate of V105B decreases, the control grid of V104 becomes more negative with respect to its cathode than in the original condition, therefore, the tube presents a higher series resistance to the output current, thereby maintaining a constant output voltage, even though the input voltage has increased. Capacitor C107 (.05uf) is connected from the grid on voltage regulator tube V104 to ground to smooth the action of the circuit by charging through resistor R104 and discharging through tube V105B, as the output voltage fluctuates. The action of the circuit is almost instantaneous. A decrease in voltage at terminal A can be explained in a like manner so that the output voltage will remain constant. Resistor R112 (SCREEN VOLTAGE ADJUST) sets the level of the output voltage by setting the bias on V105A. One side of the filament of voltage regulator tube V104 is connected to the cathode to prevent high heater to cathode potentials with resultant damage to the tube.

56. Bridge Rectifier Circuit

(fig. 21)

One of the secondary windings of transformer T102 is wound to give 115 volts at .6 ampere for either 115- or 230-volt line operation. This winding drives the blower and also supplies primary voltage for transformer T103.

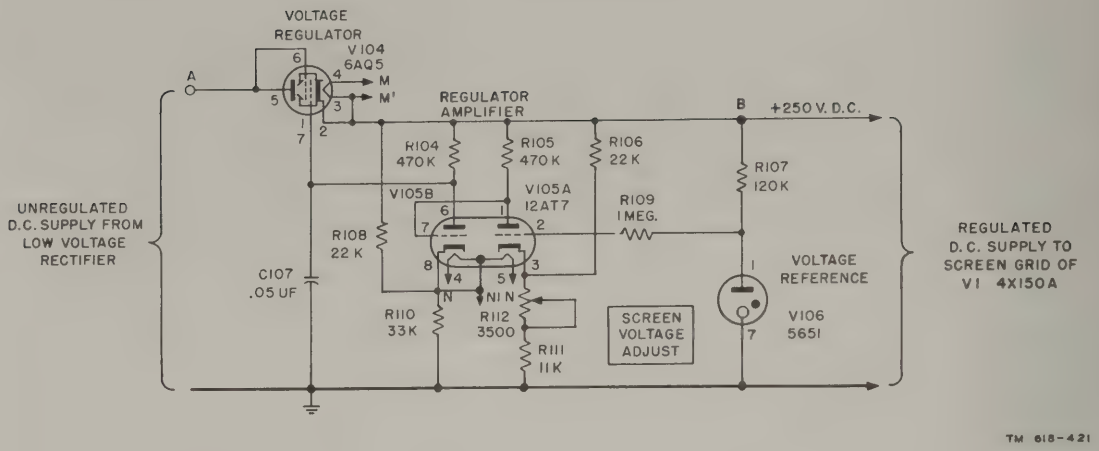


Figure 20. Screen voltage regulator, schematic diagram.

One of the secondary windings of transformer T103 is wound to give 50 volts at 10-ma output. The output of this winding is fed to a full-wave bridge rectifier circuit using a selenium rectifier CR101. This provides for −50 to −70 volt d-c bias for tube V1 (4X150A). Fuse F102 (1/16 ampere, 250 volts) protects the circuit from overload. The operation of the bridge rectifier can be explained in the following manner: Referring to figure 21, assume that terminal 3 of transformer T103 goes positive while terminal 4 goes negative. Since a positive voltage is applied to the cathode of section a of CR101, this section cannot conduct; however, since the positive voltage is applied to the anode of section b of CR101, this section can conduct. Similarly, section c, having a negative voltage applied to its cathode, can conduct. Therefore, the electron path would be from negative terminal 4 of transformer T103 through section c of CR101 to the junction of sections a and c, through the

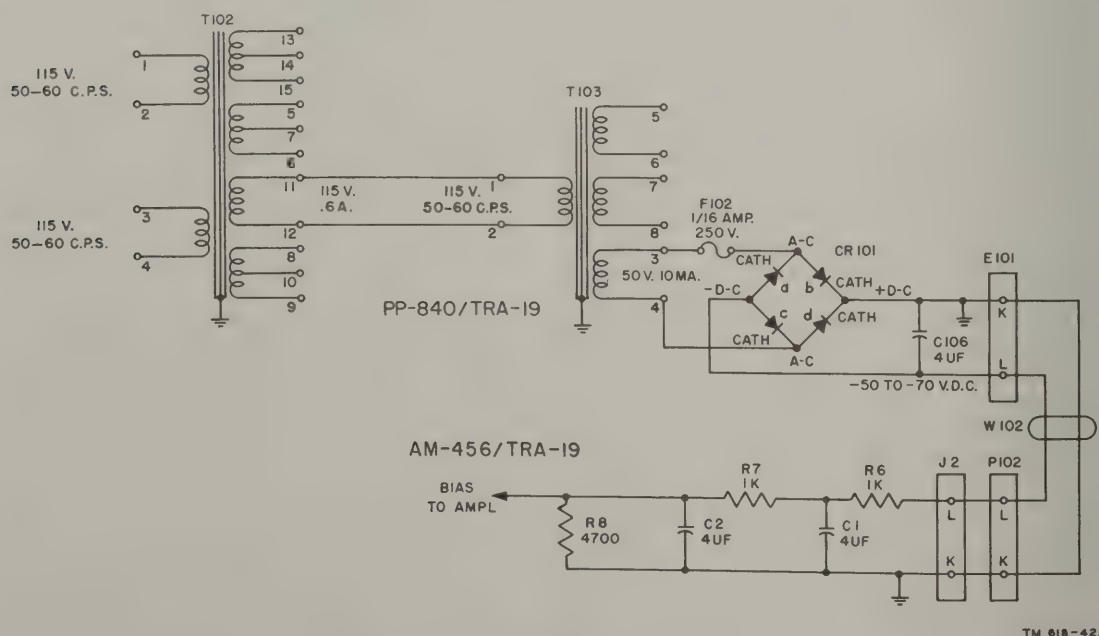


Figure 21. Bridge rectifier, schematic diagram.

load to the junction of sections b and d, and through section b to the positive terminal of transformer T103. On the next half cycle when terminal 4 is positive and terminal 3 is negative, a similar action will occur with sections a and d of CR101 conducting and sections b and c inactive. Therefore, the junction of sections a and c always will be the negative d-c terminal, and the junction of sections b and d will be the positive output terminal.

Capacitor C106 (4uf) is the input capacitor of the bias supply filter. The rest of the filter is located on the amplifier chassis. The pulsating dc is carried to terminal L of terminal board E101, through cable W102, connector P102, and jack J2 to the remainder of the filter consisting of R6 and R7 (1K each) and C1 and C2 (4uf each). Resistor R8 (4,700 ohms) performs the dual function of grid resistor and bleeder for the bias supply.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTION

Note: This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available, and by the skill of the repairman.

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing this equipment out of the case, be extremely careful since high voltages are exposed. Both the amplifier and the power supply chassis are equipped with interlock switches (S1, S2, S103, and S104) that automatically disconnect the line voltage when they are pulled forward from the case approximately 1/2 inch (fig. 23).

57. Restoring Line Voltage

In order that the line voltage may be restored for trouble shooting and repair purposes, it will be necessary to install the bayonet interlock shorting switches E6, E7, E108 and E109 (figs. 25, 29), on the rear of each chassis, as shown in fig. 22. When the chassis are removed from the case for the purpose of checking resistance, *do not install the shorting switches.* In addition discharge all capacitors with the shorting stick as described in paragraph 30*f*. If the shorting switches are installed and line voltage is applied, keep one hand in pocket while measuring socket and terminal strip voltages. Before touching any part after the voltage is shut off, short the part to ground.

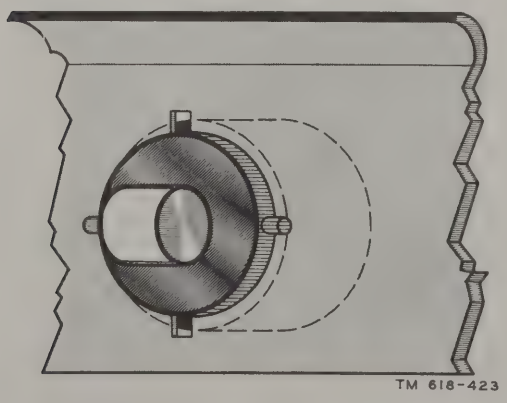


Figure 22. Interlock shorting switch.

58. Trouble-shooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the major component or circuit responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults such as burned-out resistor, r-f arcing, and shorted transformers often can be located by sight, smell, or hearing. The majority of faults, however, must be localized by checking voltage and resistance.

a. System Sectionalization. System sectionalization is discussed in paragraph 41.

b. Component Sectionalization and Localization. The tests listed below aid in isolating the source of trouble. To be effective the procedure should be followed in the order given. Remember that the servicing procedure should cause no further damage to the equipment. First, trouble should be localized to a single stage or circuit. Then trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

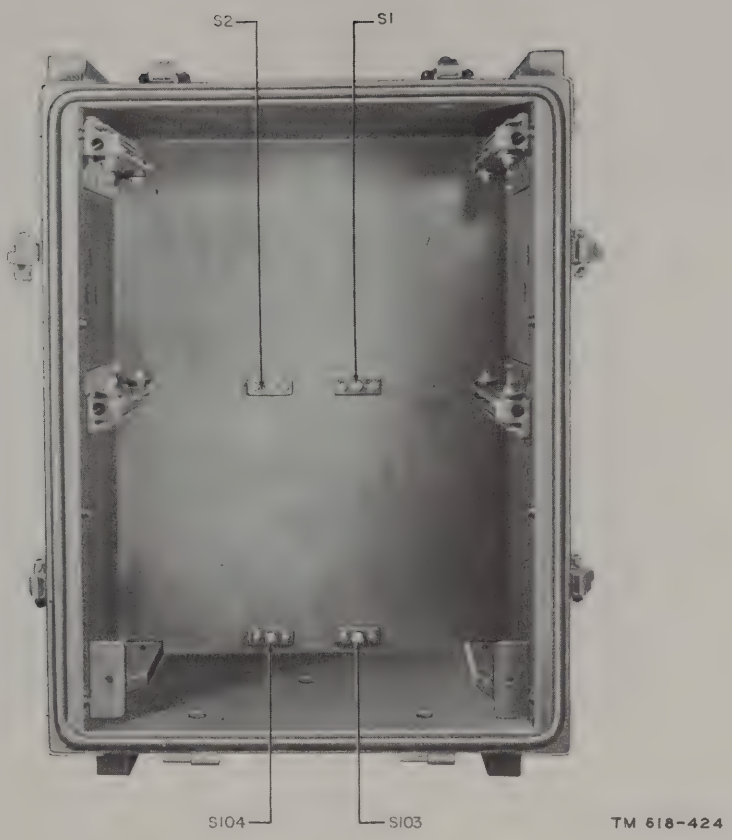


Figure 23. Interior of carrying case, showing interlock switches, S1, S2, S103, and S104.

(1) *Visual inspection.* The purpose of visual inspection (par. 40) is to locate any visible trouble. Through this procedure alone, the repairman frequently may discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the equipment which might occur through improper servicing methods and in forestalling future failures.

(2) *D-c resistance measurements.* These measurements (par. 64) may prevent further damage to the units from possible short circuits due to faulty components.

(3) *Operational test.* The operational test (par. 62) is important because it indicates the general location of the trouble.

(4) *Trouble-shooting chart.* The trouble symptoms listed in this chart (par. 63) will aid greatly in localizing trouble.

(5) *Intermittents.* In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set. It is possible that the trouble is not in the equipment itself but in the installation (mounting, interconnections, etc.), or the trouble may be due to external conditions. In this event, test the installation, if possible.

59. Trouble-shooting Data

Take advantage of the material supplied in this instruction book. It will help in the rapid location of faults. Consult the following trouble-shooting data.

a. RADIO FREQUENCY AMPLIFIER AM-456/TRA-19.

Fig. or par. No.	Description
Fig. 40	Schematic diagram.
Fig. 24	Chassis, top view.
Fig. 25	Chassis, bottom view.
Fig. 26	Chassis, right side view.
Fig. 27	Chassis, left side view.
Fig. 39	Component parts of coaxial cavity.
Fig. 42	Amplifier parts location.

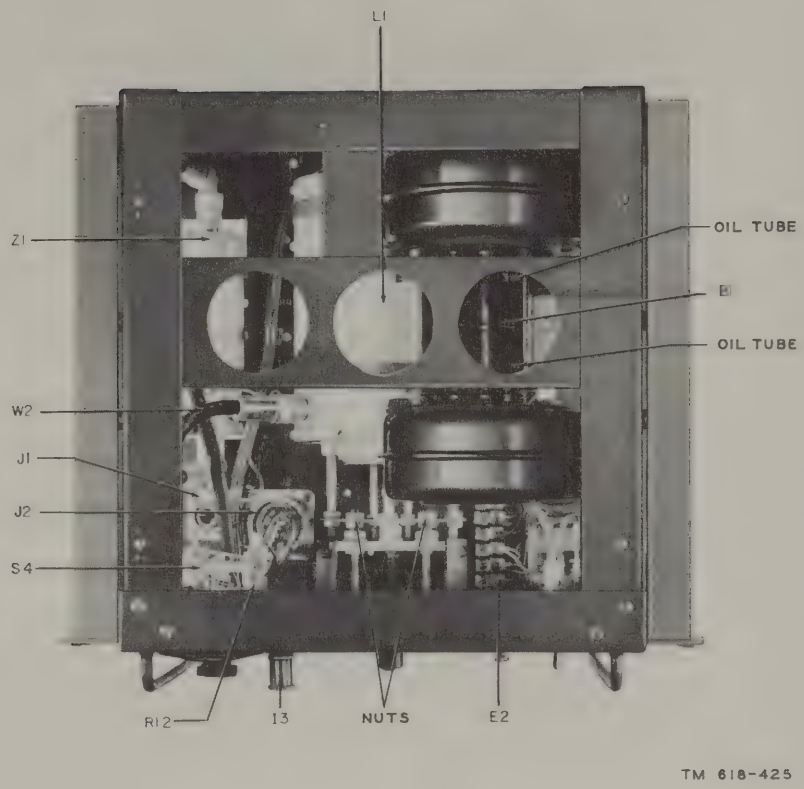


Figure 24. Radio Frequency Amplifier AM-456/TRA-19, top view of chassis.

b. Power Supply PP-840/TRA-19.

Fig. or par. No.	Description
Fig. 41	Schematic diagram.
Fig. 28	Chassis, top view.
Fig. 29	Chassis, bottom view.
Fig. 30	Chassis, right side view.
Fig. 31	Chassis, left side view.
Fig. 32	Tube socket voltage and resistance diagram.
Fig. 43	Power supply parts location.
Par. 64	Transformer d-c resistances.

c. Miscellaneous Figures.

Fig. or par. No.	Description
Fig. 9	Shorting stick.
Fig. 22	Interlock shorting switches.
Fig. 36	Resistor color codes.
Fig. 37	Capacitor color codes.

60. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting Amplifier-Power Supply Group AN/TRA-19 is listed below. The technical manuals associated with the equipment also are listed.

Test equipment	Technical manual
Multimeter TS-352/U	TM 11-5527
Tube Tester I-177-A	TM 11-2627
RF Wattmeter ME-11 ( )/U	NAVSHIPS 91118

61. General Precautions

Whenever the equipment is serviced, observe the following precautions carefully:

a. Be careful when handling high-voltage cable W101 and its connections when the equipment is out of the case and current is on.

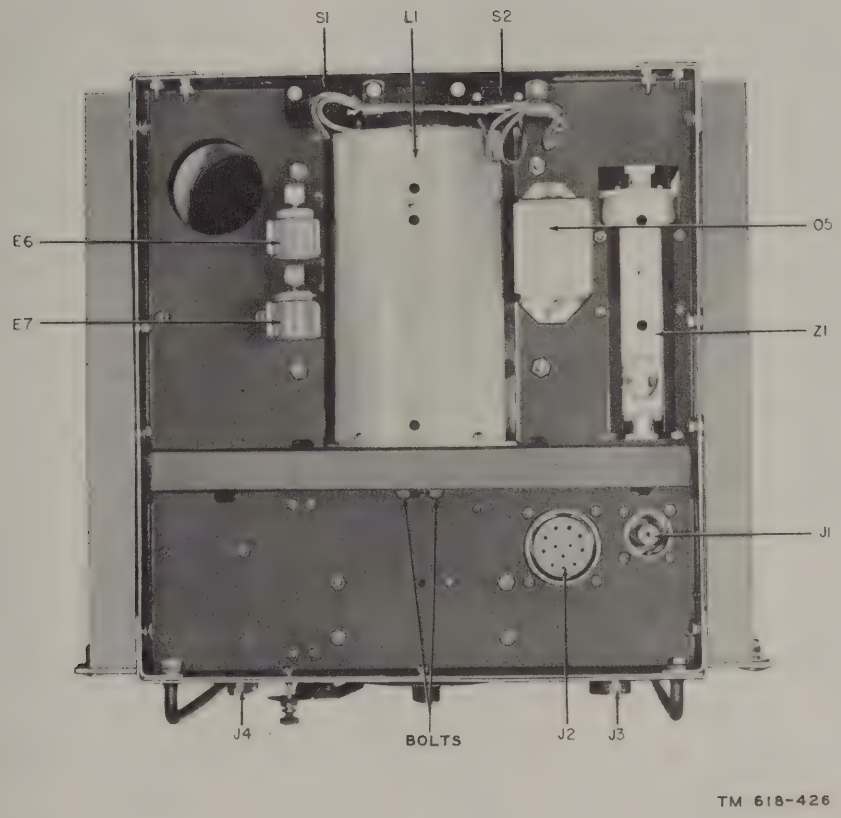


Figure 25. Radio Frequency Amplifier AM-456/TRA-19, bottom view of chassis.

b. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer or filter, has a number of connections, tag each lead to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the set, since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joint, since a poorly soldered joint is one of the most difficult faults to locate.

62. Operational Tests

If the equipment is connected for normal operation, operate it as described in the equipment performance checklist (par. 43). This checklist is important because it frequently indicates the general location of the trouble. Also listen for crackling or buzzing noises which indicate high-voltage arcing. Check the equipment for smoke and the odor of burned or overheated parts.

63. Trouble-shooting Chart

The trouble-shooting chart and figures 24 through 33 are supplied as an aid in locating trouble in the amplifier or power supply. The chart lists the symptoms which the repairman observes while making a few simple tests. Once the trouble has been localized to a stage or circuit, a tube check and a voltage and resistance measurement of this stage ordinarily should be sufficient to locate the defective part. Normal voltage and resistance measurements are given in figure 32.

63. Trouble-shooting Chart (contd)

Symptom	Probable trouble	Correction
1. No meter readings.	1. Defective power supply.	1. Repair.
	Defective meter M1.	Replace.
	Defective switch S4.	Clean contacts or replace.
2. No reading in position 2, PLATE VOLTS.	2. Open resistor R4.	2. Replace.
	Defective tubes V102 and V103.	Replace.
	Open choke L101.	Replace.
	Defective relay K101.	Replace.
	Defective transformers T101 and T102.	Replace.
High reading in position 2.	Open resistor R12.	Replace.
3. No reading in position 3, SCREEN VOLTS.	3. Open resistor R3.	3. Replace.
	Defective transformer T102.	Replace.
	Open resistor R2.	Replace.
	Blown fuse F101.	Replace.
	Open choke L102.	Replace.
	Defective rectifier tube V101 or voltage regulator tube V104.	Replace.
Low or high reading in position 3.	Defective voltage regulator tube V104, or regulator amplifier tube V105, or voltage reference tube V106.	Replace.
	SCREEN VOLTAGE ADJUST potentiometer misadjusted.	Adjust.
High reading in position 3.	Shorted capacitor C107.	Replace.
	Open resistor R105.	Replace.
	Open resistor R106.	Replace.
	Open resistor R110.	Replace.
Low reading in position 3.	Open resistor R107.	Replace.
	Open resistor R108.	Replace.
	Open resistor R109.	Replace.
	Open resistor R111.	Replace.
	Open resistor R112.	Replace.
4. No reading in position 4, CATHODE CUR.	4. Defective tube V1.	4. Replace.
Low reading in position 4.	Defective tube V1.	Replace.
High reading in position 4.	Blown fuse F102. (T-30 ( )/TRC-8 OFF.)	Replace.
	Shorted capacitor C1, C2, or C106.	Replace.
	Defective selenium rectifier CR101.	Replace.
	Open resistor R6 or R7.	Replace.
5. No reading in position 5, SCREEN CUR.	5. Blown fuse F101.	5. Replace.
	Shorted capacitors C104 and C105.	Replace.
	Defective tube V1.	Replace.
	Open filter choke L102.	Replace.
	Defective tube V104.	Replace.

63. Trouble-shooting Chart (contd)

Symptom	Probable trouble	Correction
High reading in position 5.	Open antenna connections.	Repair.
	Open resistor R2.	Replace.
Low reading in position 5.	Defective tube V1.	Replace.
6. No reading in position 6, GRID CUR.	6. Open resistor R8 or R10	6. Replace.
	Shorted capacitor C3.	Replace.
	Open choke L2.	Replace.
	Defective tube V1.	Replace.
	Defective input cable connections.	Repair.
	Defective T-30 ( )/TRC-8.	Repair.
Low reading in position 6.	Defective tube V1.	Replace.
	Defective T-30 ( )/TRC-8.	Repair.
High reading in position 6.	Open resistor R6, R7, or R9.	Replace.
	Blown fuse F102.	Replace.
	Shorted capacitor C1, C2, or C106.	Replace.
	Defective selenium rectifier CR101.	Replace.
7. No reading in position 7, PWR. OUT.	7. Defective crystal CR1.	7. Replace.
	Defective tube V1.	Replace.
	Open resistor R11.	Replace.
Low reading in position 7.	Defective crystal CR1.	Replace.
	Defective tube V1.	Replace.
	R11 misadjusted.	Adjust.

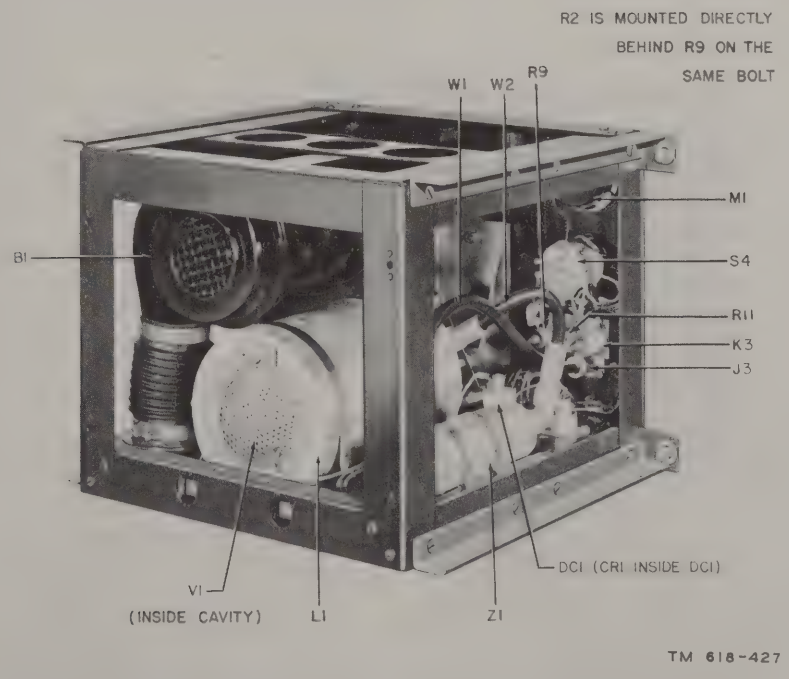


Figure 26. Radio Frequency Amplifier AM-456/TRA-19, right side view of chassis.

64. D-c Resistances of Transformers and Chokes

The d-c resistances of the chokes and transformer windings in the equipment are listed below:

Transformer or choke	Terminals	Ohms
T101	1-2	1.5
	3-4	1.5
	5-6	20
	6-7	17
	7-8	17
	8-9	20
	6-8	35
	5-9	75
	5-7	37
	7-9	37
T102	1-2	2.8
	3-4	2.8
	5-6	.1
	5-7	.05
	6-7	.05
	8-9	.1
	8-10	.05
	9-10	.05
	11-12	3.6
	13-14	.05
	13-15	.1
	14-15	.05
T103	1-2	180
	3-4	300
	5-6	1.4
	7-8	2.4
L101	1-2	165
L102	1-2	350

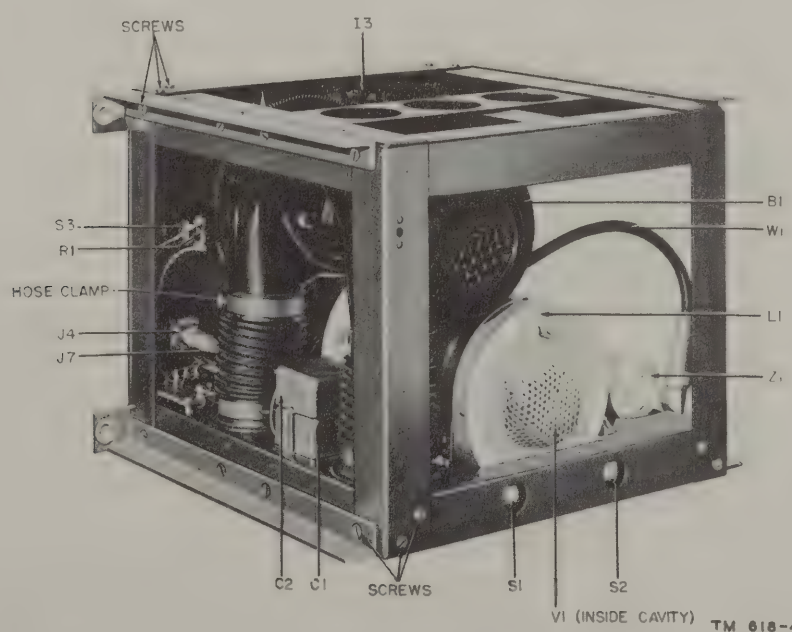


Figure 27. Radio Frequency Amplifier AM-456/TRA-19, left side view of chassis.

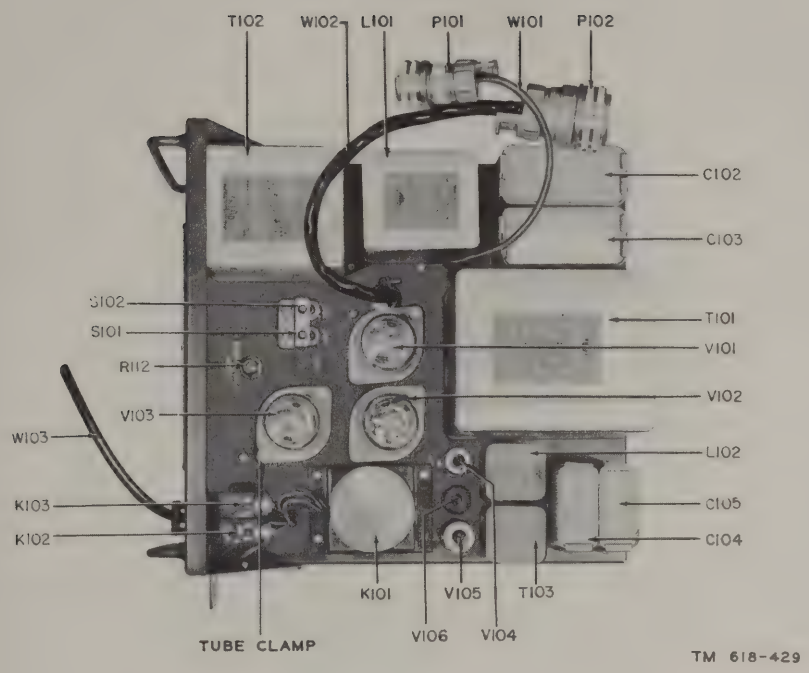


Figure 28. Power Supply PP-840/TRA-19, top view of chassis.

Section II. REPAIRS

65. Replacement of Parts

a. Replacement of Parts on Radio Frequency Amplifier AM-456/TRA-19.

(1) *General.* Most of the parts in Amplifier-Power Supply Group AN/TRA-19 are easily replaceable. If wires must be removed to make repairs, mark each one with a tag showing where it is to be connected.

(2) *Removing Dust Covers.* There are three dust covers, one on each side and one that covers both the top and the rear.

(*a*) To remove the side cover, remove the eight binding head screws at the top and bottom of the cover.

(*b*) To remove the top cover, loosen the eight Dzus fasteners, four on top and four in the rear. A slight turn to the left disengages these fasteners.

(3) *Removing Blower Frame Assembly.*

(*a*) Remove the dust covers as described in subparagraph (2) above.

(*b*) Loosen the two upper hose clamps (fig. 27) after loosening the screw on each clamp.

(*c*) Remove the two blower wires from terminal board E2. Note the terminals from which they have been removed.

(*d*) Remove the three painted screws in the lower rear corners. Remove the three painted screws in the upper front corners (fig. 27).

Note. It may be necessary to *loosen* the flat-headed screws in the upper and lower mounting slides to relieve tension on the frame.

(*e*) Lift the frame assembly and slide it back.

(4) *Replacing Blower.*

(*a*) Remove the blower frame assembly as described in subparagraph (3) above.

(*b*) Remove the four hexagonal nuts that hold the blower to the frame assembly.

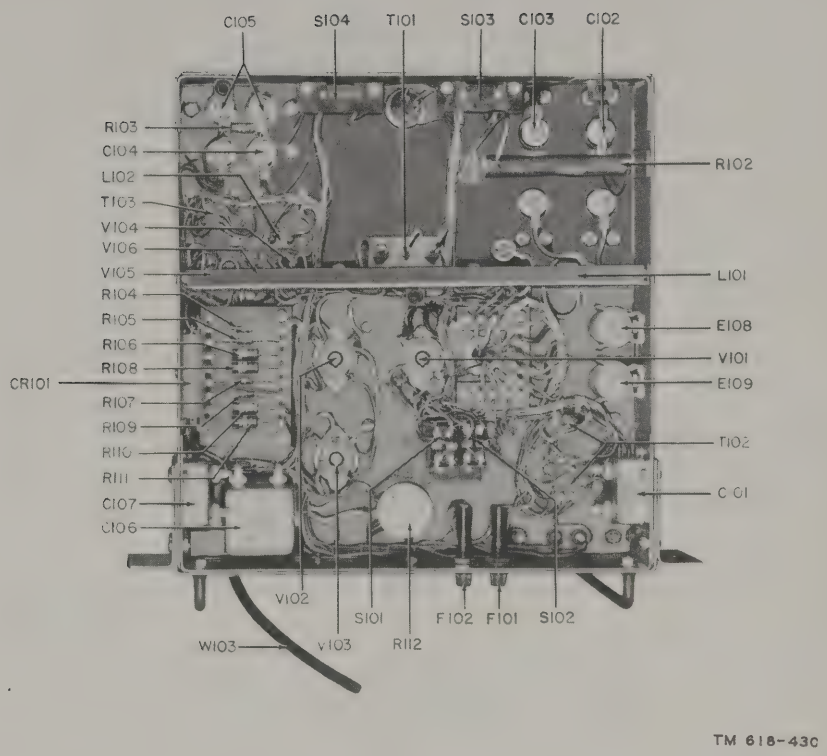


Figure 29. Power Supply PP-840/TRA-19, bottom view of chassis.

(*c*) Squeeze the mounting flanges to disengage the blower.

(5) *Replacing Amplifier Tube V1.*

(*a*) Remove the top and rear dust cover as in subparagraph (2) above.

(*b*) Remove the perforated tube shield (item 52, fig. 39) which is held by two screws.

(*c*) Remove the four screws that are underneath the shield. This disconnects the high-voltage lead attached to one of the screws.

(*d*) Pull gently on the tube, which will come out with the plate contact spring (item 48, fig. 39) attached. This contact spring has fingers that press against the side of the tube. Slide the spring in the direction of the tube base to avoid the spring fingers digging into the surface.

(*e*) Gently replace the tube, making sure that the tube key is in the proper position.

(*f*) Put the contact spring on the new tube, sliding it on toward the base of the tube, with the spring fingers in the opposite direction. Position the ring so that the screw holes line up.

(*g*) Replace the four screws that hold the contact spring, connecting the plate lead as before. (It must be run through the hole in the shield.)

(*h*) Replace the perforated tube shield with its two screws.

(*i*) Replace the dust covers.

(6) *Replacing Crystal CR1.*

(*a*) Crystal CR1 is contained within directional coupler DC1 which is inserted into low-pass filter Z1.

(*b*) Remove the dust cover on the side as described in subparagraph (2) above.

(*c*) Remove the nut at the top of the directional coupler and disconnect the lead.

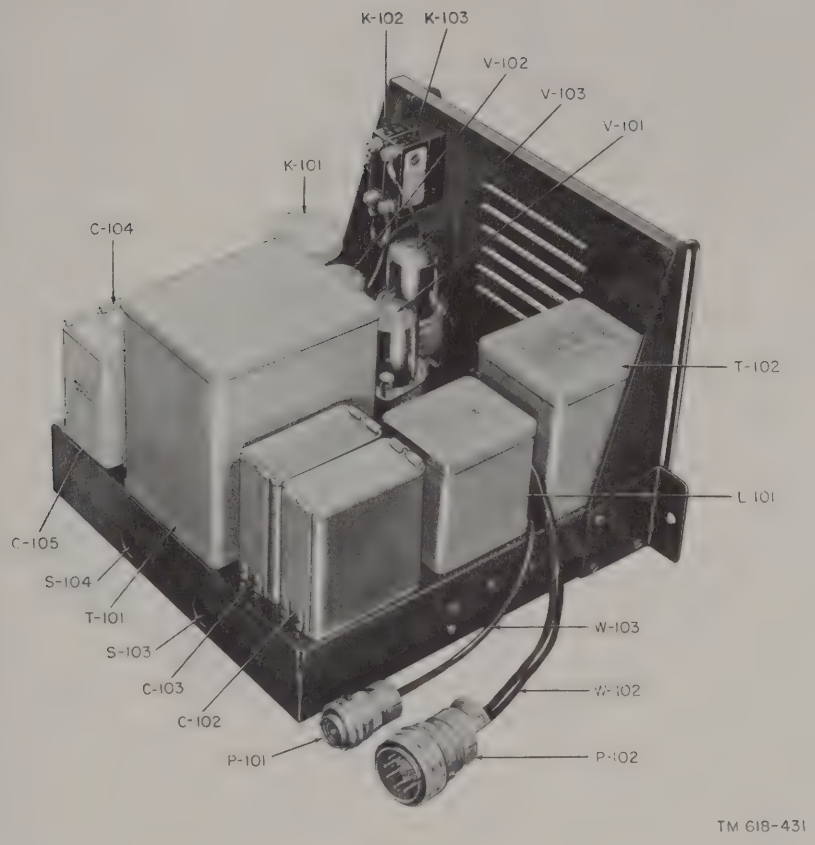


Figure 30. Power Supply PP-840/TRA-19, right side view of chassis.

(*d*) Unscrew the knurled portion of the directional coupler.

(*e*) With a pair of pliers, pull the crystal out by grasping the ring that surrounds the flat-headed screw.

(*f*) Realine the directional coupler (par. 68*c*).

(7) *Replacing cavity L1* (figs. 24 and 25).

(*a*) Remove the top and side dust covers as described in subparagraph (2).

(*b*) Remove the blower frame assembly (with blower) as described in subparagraph (3) above.

(*c*) Disconnect the four cabled leads that run from the cavity to terminal board E2. Tag the leads.

(*d*) Disconnect the ground wire that runs from the side of the cavity to terminal board E2.

(*e*) Disconnect input cable W3 from panel connector J4 by turning the knurled portion of J4 in the rear of the panel.

(*f*) Disconnect output cable W2 from the cavity by unscrewing connector P1.

(*g*) Remove the two nuts that secure the dial drive to the dial assembly (fig. 24).

(*h*) Remove the two bolts that secure the cavity to the blower air duct (fig. 25).

(*i*) Remove the four nuts on the cavity holding straps on the bottom of chassis (fig. 25).

(*j*) Remove the two screws that secure the perforated tube shield to the rear of the cavity and disconnect the plate lead.

(*k*) Remove the cavity.

(*l*) When the cavity is replaced, refer to paragraph 68*a* and *b* for alinement procedure.

b. Replacement of Rectifier Tubes V101, V102, and V103 on Power Supply PP-840/TRA-19.

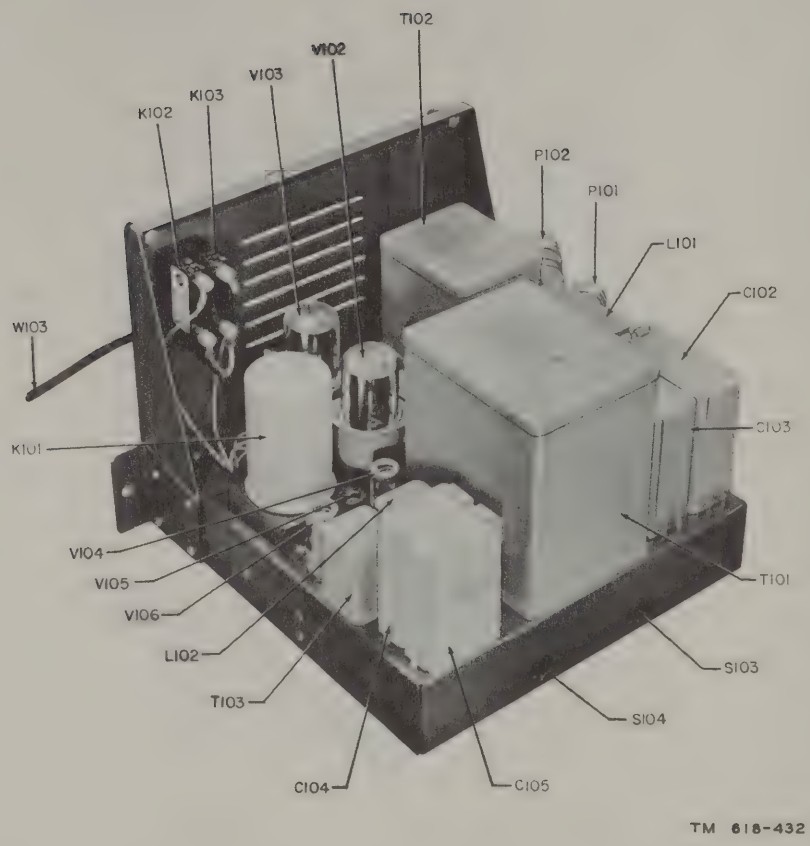


Figure 31. Power Supply PP-840/TRA-19, left side view of chassis.

(1) Remove the two thumbscrews that secure each tube clamp (fig. 28).

(2) Lift the clamp from the tube.

(3) Remove the tube by pulling.

66. Disassembly and Lubrication of Equipment at Field Maintenance Level

The dial drive assembly and the blower motor (B1) will require subsequent lubrication at the field maintenance level. Follow the instructions described in pars. 35 and 36.

Section III. ALINEMENT PROCEDURES

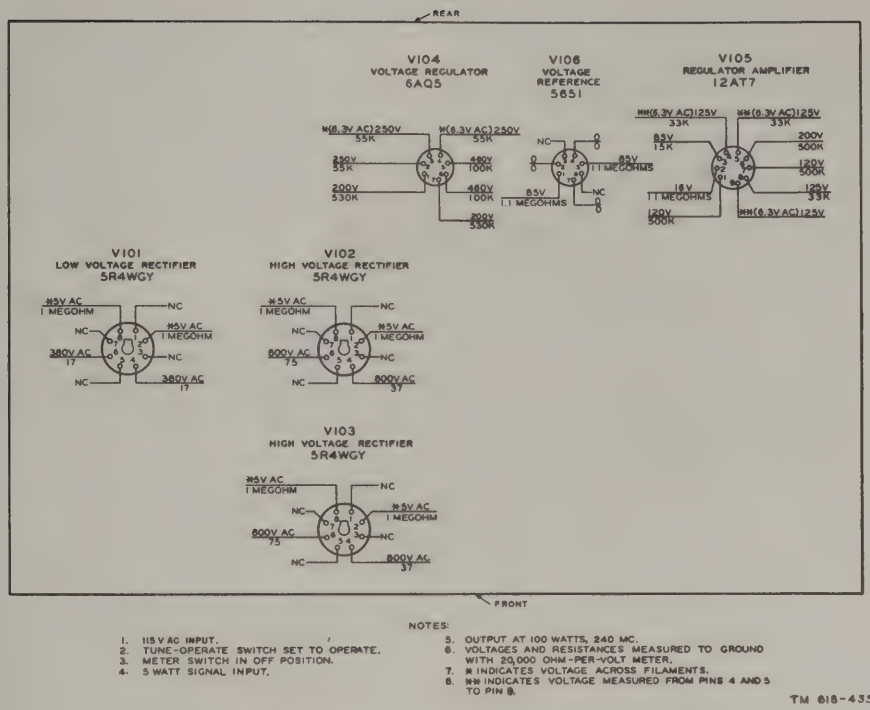
67. Test Equipment Required for Alinement

a. Radio-Frequency Wattmeter. An RF Wattmeter ME-11 ( )/U is required for the accurate measurement of the r-f output of Radio Frequency Amplifier AM-456/TRA-19. It is necessary that two lengths of Cord CG-55/U (60 feet each) be used to feed the wattmeter to avoid damage because of too much power being dissipated in the wattmeter. The loss in 120 feet of RG-8A/U cable should be sufficient to protect the wattmeter. If the wattmeter reads off scale, an additional 60 feet of cable may be added.

b. Radio Transmitter T-30 ( )/TRC-8. Alinement procedure requires the use of a Radio Transmitter T-30 ( )/TRC-8 that has been calibrated recently in frequency as described in the instruction book for Radio Set AN/TRC-8( ), Radio Terminal Set AN/TRC-11( ), and Radio Relay Set AN/TRC-12( ).

68. Alinement and Adjustment Procedures

Caution: Do not attempt to aline the equipment unless it hasbeen determined definitely that alinement is necessary.



NOTES:

1. 115 V AC INPUT.
2. TUNE-OPERATE SWITCH SET TO OPERATE.
3. METER SWITCH IN OFF POSITION.
4. 5 WATT SIGNAL INPUT.
5. OUTPUT AT 100 WATTS, 240 MC.
6. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH 20,000 OHM-PER-VOLT METER.
7. * INDICATES VOLTAGE ACROSS FILAMENTS.
8. ** INDICATES VOLTAGE MEASURED FROM PINS 4 AND 5 TO PIN 8.

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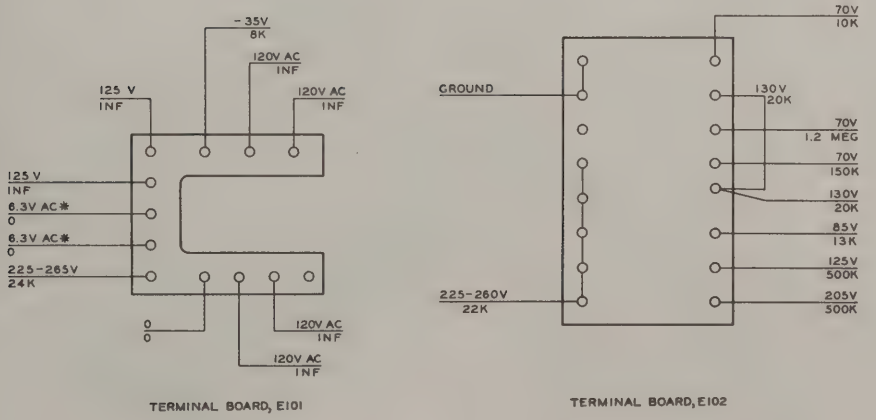
Figure 32. Amplifier-Power Supply Group AN/TRA-19, tube-socket and resistance voltage diagram.



NOTES:

1. 115-VOLT A-C INPUT.
2. METER SWITCH IN POWER OUT POSITION.
3. 20,000 OHMS-PER-VOLT METER.
4. ALL MEASUREMENTS TO GROUND.
5. TUNE-OPERATE SWITCH IN OPERATE POSITION.
6. * INDICATES VOLTAGE ACROSS FILAMENTS.
7. ALL VOLTAGES POSITIVE D-C UNLESS OTHERWISE INDICATED.

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Figure 33. Amplifier-Power Supply Group AN/TRA-19, resistor-capacitor board voltage diagram.

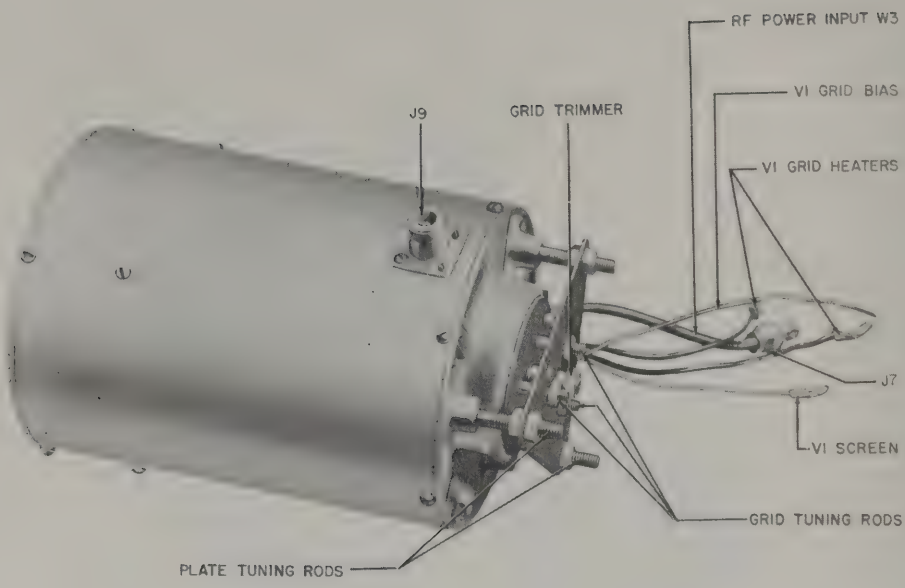


Figure 34. Side, front view of cavity.

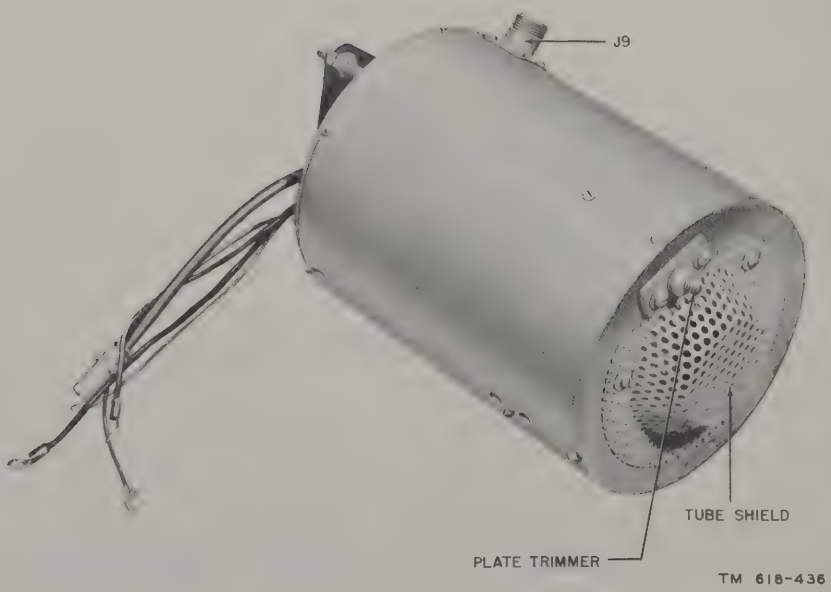


Figure 35. Side, rear view of cavity.

a. Electrical Alinement of Cavity.

(1) Disconnect the power supply cables from the amplifier and remove both chassis from the case. Remove the amplifier dust cover.

(2) Place both chassis on their sides in a manner that will permit interlock shorting switches (fig. 22) to be inserted.

(3) Connect Cord CG-55/U (4 feet) from the ANTENNA receptacle of Radio Transmitter T-30( )/TRC-8 to the INPUT receptacle on the amplifier. Connect two lengths of Cord CG-55/U (60 feet each) from the ANTENNA receptacle on the amplifier to the input receptacle on the r-f wattmeter.

(4) Set the OPERATE-TUNE switch to TUNE and the meter selector switch to position 7, PWR. OUT. Set the FREQUENCY MEGACYCLES dials on the transmitter and amplifier to exactly 235 mc.

(5) Turn on the amplifier and transmitter and adjust the transmitter for maximum output as described in the instruction book for Radio Set AN/TRC-8 ( ). The transmitter should have been alined on its dummy load or on the system antenna.

(6) Loosen the locknut on the amplifier plate trimmer (fig. 35) with the spanner wrench (fig. 7). Slowly adjust the trimmer (threaded rod with screwdriver slot in the end) with a screw driver for maximum power output as observed on the r-f wattmeter. Carefully tighten the locknut at the conclusion of the adjustment.

(7) Set the meter selector switch to position 6, GRID CUR. Loosen the locknut on the amplifier grid trimmer (fig. 34) with the spanner wrench. Using the thumb and forefinger, slowly rotate the grid trimmer for maximum grid current as observed on meter M1. Carefully tighten the locknut at the conclusion of the adjustment.

(8) Set the meter selector switch to position 7, PWR. OUT., and set the OPERATE-TUNE switch to OPERATE. Repeak the plate and grid trimmers as described in subparagraphs (1) through (7) above. Retune the OUTPUT TUNING knob on Radio Transmitter T-30( )/TRC-8 so that the amplifier power output is 40 watts as observed on r-f wattmeter.

(9) Loosen the locknut on r-f power calibrating potentiometer R11 (fig. 26), and adjust until meter M1 reads .4. Tighten the locknut at the conclusion of the adjustment. The discrepancy between this reading and the wattmeter reading is due to the loss in the CG-55/U cord.

(10) Set the meter selector switch to position 4, CATHODE CUR. Loosen the locknut on SCREEN VOLTAGE ADJUST potentiometer R112 (fig. 26), and adjust until meter M1 reads 60. Tighten the locknut at the conclusion of the adjustment.

Note. Make certain that the line voltage is 117 volts during the above adjustment.

(11) Disconnect the test equipment and install the amplifier and power supply in the case. Be sure that the interlock shorting switches are replaced in their holders (figs. 25 and 29).

b. Mechanical Alinement of Cavity (figs. 34 and 35). The mechanical alinement that follows is performed only if it becomes necessary to disassemble or remove the cavity from its mounting.

(1) Position the three outer nylon rods (plate tuning) for maximum external rod length. Make a reference mark on the rods; then move them toward the cavity exactly 1 inch. In this position, the plate circuit will be tuned to 230 mc.

(2) Position the three inner nylon rods (grid tuning) for minimum external rod length. Make a reference mark on the rods; then move them away from the cavity exactly 1/8 inch. In this position, the grid circuit will be tuned to 230 mc.

(3) While the grid and plate tuning are set for 230 mc, tighten the control plate which secures the six nylon rods in a position 1/2 inch from the ends of the outer rods (measure from end of rod to edge of plate nearest rod end).

(4) Before the rod drive plate is secured to the dial drive assembly, rotate the dial to a 230-mc position. Following this, move the dial drive plate so that the six nylon rods are in the 230-mc position determined in the preceding subparagraph. Fasten the drive plate to the dial drive assembly in this position.

c. Alinement of Directional Coupler (fig. 26).

(1) Connect the r-f wattmeter to the ANTENNA receptacle on the amplifier with Cord CG-55/U (60 feet). Connect Cord CG-55/U (4 feet) between INPUT receptacle on the amplifier and the ANTENNA receptacle on Radio Transmitter T-30( )/TRC-8.

(2) Set the meter selector switch to position 7, PWR. OUT. Turn on the transmitter and amplifier. Adjust the transmitter and amplifier for normal operation.

(3) Loosen the two setscrews that position the directional coupler (DC1) in the low-pass filter (Z1) housing, by using the Allen wrench provided. Push the directional coupler into the low-pass filter as far as possible.

(4) Reposition the directional coupler approximately 1/8 inch out from its innermost position and rotate it; observe the r-f wattmeter for maximum reading. Tighten the setscrews in this position.

Section IV. FINAL TESTING

69. General

This section is intended as a guide to be used in determining the quality of a repaired Amplifier-Power Supply Group AN/TRA-19. The minimum test requirements outlined in paragraphs 70 and 71 may be checked by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

70. Test Equipment Required for Final Testing

RF Wattmeter ME-11( )/U and Radio Transmitter T-30( )/TRC are required for final testing. The transmitter must have been calibrated recently in frequency as described in the instruction book for Radio Set AN/TRC-8( ).

71. Final Test Procedure

a. Connect two lengths of Cord CG-55/U (60 feet each) between the ANTENNA receptacle on the amplifier and the r-f wattmeter. Connect Cord CG-55/U (4 feet) between the ANTENNA receptacle on the transmitter and the INPUT receptacle on the amplifier. Turn the equipment on and allow for sufficient tube warm-up.

b. Set the OPERATE-TUNE switch to OPERATE and the meter selector switch to position 7, PWR. OUT. Set the transmitter and amplifier FREQUENCY MEGACYCLES dials to exactly 235 mc, and adjust the transmitter for maximum power output.

c. Observe the reading obtained on the r-f wattmeter; if it is 40 watts or greater, the equipment performance can be considered satisfactory.

d. Check the meter readings in all positions; compare them with the readings shown on the SELECTOR SWITCH label mounted on the front of the amplifier panel.

e. Adjust the transmitter FREQUENCY MEGACYCLES dial to exactly 230 mc. Tune the amplifier for maximum power output as indicated on the meter with the selector switch in the PWR. OUT. position. The reading on the r-f wattmeter should be 40 watts or more.

f. Repeat the step in subparagraph *e* above at exactly 250 mc.

g. Shut off all the equipment and disconnect the transmitter and wattmeter.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

72. Disassembly

The following instructions are recommended as a guide for preparing the radio set for transportation and storage.

a. Disconnect the interunit cording and cabling.

b. If the equipment has been used, remove the cover from the top of the carrying case and secure it in its proper place for transportation.

c. Return the equipment to the case in which it was shipped.

73. Repacking for Shipment or Limited Storage

a. The carrying case for this equipment has been designed to furnish adequate protection for its contents under all conditions of domestic shipment. The protection is not sufficient, however, for exporting the equipment. Additional packing is required for oversea shipment, and reference should be made to U. S. Army Specification No. 100-14A for specific export packing instructions. In preparing the equipment for oversea shipment, all tubes not equipped with tube clamps should be held in place with masking tape to prevent damage.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the chassis. Protect the chassis with a waterproof paper barrier. Seal the seams of the waterproof paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least three inches of excelsior padding or similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

74. General

The demolition procedures outlined in paragraph 75 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commanding officer.

75. Methods of Demolition

a. SMASH. Smash the r-f units, tubes, controls, coils, switches, capacitors, and transformers, using sledges, axes, or handaxes.

b. CUT. Cut cords and wiring, using axes, handaxes, or machetes.

c. BURN. Burn cords, resistors, capacitors, coils, wiring, and instruction books, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. EXPLOSIVES. If explosives are necessary, use firearms, grenades, or TNT.

e. DISPOSAL. Bury or scatter the destroyed parts in slit trenches, foxholes, or other holes, or throw them in streams.

f. DESTROY. Destroy everything.

APPENDIX 1

REFERENCES

Note. For availability of items listed, check SR 310-20-3, SR 310-20-4, and SR 310-20-5. Check Department of the Army Supply Catalog SIG 1 for Signal Corps Supply Catalog pamphlets.

1. Army Regulations

AR 380-5	Military Security (Safeguarding Military Information).
AR 750-5	Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Bulletins

SB 11-47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11-76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Auxiliary Equipment and Test Equipment

NAVSHIPS 91118	RF Wattmeter ME-11/U.
TM 11-300	Frequency Meter Sets SCR-211-A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL.
TM 11-303	Test Sets I-56-C, I-56-D, I-56-H, and I-56-J.
TM 11-307	Signal Generators I-72-G, H, J, K, and L.
TM 11-472	Repair and Calibration of Electrical Measuring Instruments.
TM 11-2524	Oscillators I-151-A and I-151-E.
TM 11-2526	Oscilloscope BC-1060-A.
TM 11-2613	Voltohmmeter I-166.
TM 11-2624B	Voltohmmeters, TS-294/U, TS-294B/U, and TS-294C/U.
TM 11-2626	Test Unit I-176, I-176-A, and I-176-B.
TM 11-2627	Tube Testers I-177 and I-177-A.
TM 11-4700	Electrical Indicating Instruments and Test Sets, Repair Instructions.
TM 11-5527	Multimeter TS-352/U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TM 9-2851	Painting Instructions for Field Use.

5. Camouflage, Decontamination, and Demolition

FM 5-20	Camouflage, Basic Principles.
FM 5-25	Explosives and Demolitions.
TM 3-220	Decontamination.

6. Other Publications

FM 24-18	Field Radio Techniques.
FM 72-20	Jungle Warfare.
SR 310-20-3	Index of Training Publications.
SR 310-20-4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowance, Tables of Organization, and Tables of Equipment.
SR 310-20-5	Index of Administrative Publications.
SR 700-45-5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD-247).
SR 745-45-5 NAV DEPT SERIAL 85P00 AFR 71-4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD-66 (Army), SandA-70-6 (Navy), and AF-MC-U2 (Air Force)).
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.

TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TB SIG 223	Field Expedients for Wire and Radio.
TM 11-314	Antennas and Antenna Systems.
TM 11-453	Shop Work.
TM 11-455	Radio Fundamentals.
TM 11-466	Radar Electronic Fundamentals.
TM 11-476	Radio Direction Finding.
TM 11-483	Suppression of Radio Noises.
TM 11-486	Electrical Communication Systems Engineering.
TM 11-496	Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets.
TM 11-661	Electrical Fundamentals (Direct Current).
TM 11-681	Electrical Fundamentals (Alternating Current).
TM 11-4000	Trouble Shooting and Repair of Radio Equipment.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O&E, T/A, SIG 7&8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7&8 AN/TRA-19. For an index of available supply catalogs, in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Amplifier-Power Supply Group AN/TRA-19

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	AMPLIFIER-POWER SUPPLY GROUP AN/TRA-19: AC, 115 or 230 v, 50 or 60 cyc, single ph, 440 w; 1 Sig C Amplifier AM-456/TRA-19; 1 Sig C Power Supply PP-840/TRA-19; 1 Sig C Case CY-1204/TRA-19; 1 Sig C Cable CG-55C/U; amplifies output of transmitter T-30/TRC-8; MIL-A-10489.	Amplifier for Transmitter T-30/TRC-8.	2C450-1
	AMPLIFIER, RF: AM-456/TRA-19; 230 to 250 mc freq range; 75 w power output, 50 ohms output impedance; input 5 watts required for excitation, 50 ohms input impedance; operated by output of Sig C Power Supply PP-840/TRA-19; 11-⅛″ h x 15-¾″ wd x 15-¼″ d o/a; mts in Sig C Case CY-1204; MIL-A-10489.	R-f Amplifier.	2C448A-456
	POWER SUPPLY: PP-840/TRA-19; 3 5R4WGY tubes; output data, DC 890 v, 230 ma, unregulated; DC 250 v, 30 ma, regulated; DC -50 to -70 v, 10 ma, unregulated; DC .05 v, .215 amp, unregulated; AC 115 v, .6 amp, unregulated; AC 6 v, 3.5 amp, unregulated; input data, AC 115 or 230 v, 50 or 60 cyc, single ph, 440 w; MIL-A-10489.	Furnishes power for Amplifier AM-456/TRA-19.	3H4497-840
	CASE: Standardized Components Electrical CY-1204/TRA-19; case for Amplifier AM-456/TRA-19 and Power Supply PP-840/TRA-19; approx 27″ h x 20-½″ wd x 17-½″ d o/a.	Case for Amplifier-Power Supply Group AN/TRA-19.	6F300-120A
	CORD CG-55/U: AN, Radio Frequency Cable RG-8A/U; coaxial; 52 ohms characteristic impedance; max operating voltage, 4000 rms; single cond, 7 strands, #21 AWG, copper wire, plain finish; dielectric data, polyethylene, .285″ OD; .405″ dia o/a; 4 ft 3-½″ o/a, assembly 4 ft lg excluding term.; connector, plug, 2 type UG-21B/U.	Connects Amplifier AM-456/TRA-19 to Transmitter T-30/TRC-8.	3E6015-55C.1
M1	AMMETER: DC; 0 to 1 ma; 2% accuracy at full scale reading; 100 ohms resistance across term. sensitivity; for general purpose use; MR26W156SPECR.	Multiple circuit monitor.	3F891-105
O22	BALL BEARING: steel 3/32″ dia.	For tuning shaft.	3H250-13
B1	BLOWER: centrifugal type, squirrel cage fans (2); 35 w, 3000 rpm, 115 v 60 cyc; 100 cu ft of air per min; single speed, turns on w/radio set direct drive.	Air-cools amplifier tube and power supply.	3H381-20

2. Identification Table of Parts for Amplifier-Power Supply Group AN/TRA-19 (cont'd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E2	BOARD, terminal: 7 pairs #6-32 brass, nickel pl screw term., ea pair connected electrically; 3-13/16″ lg x 1-⅛″ wd x ½″ h o/a.	General purpose terminal strip.	2Z9407-70
0101	BUSHING: neoprene; cyl; 13/32″ lg, 7/16″ ID, 13/16″ OD.	Bushing between W102 and H105.	3H640.18
0102	BUSHING: neoprene; cyl; 13/32″ lg, ¼″ ID, 9/16″ OD.	Bushing between W101 and H104.	3H640.19
W103	CABLE, power: electrical: 2 #16 AWG stranded rubber ins cond; 300 v rms max rated working voltage; 10′ 6″ lg.	A-c power cord assembly.	1B3016-2.28
W301	CABLE, RF: RG-8A/U; coaxial; nom impedance 52 ohms, 29.5 uuf nom capacitance per ft, max operating voltage, 4000 rms.	Connects output of Transmitter T-30/TRC-8 to input J4 of Amplifier AM-456/TRA-19.	1F425-8A
C1, C2	CAPACITOR, fixed: paper; 4 uf, +20% −10%; 100 vdcw; mineral oil filled; JAN type CP53B1EB405V.	Bias filters.	3DB4-281
C101, C107	CAPACITOR, fixed: paper; 50,000 uuf +20% −10%; 600 vdcw; JAN type CP54B1EF503V.	C101: Relay surge protector. C107: Bias stabilizer.	3DA50-477
C102, C103	CAPACITOR, fixed: paper; 4 uf +20% −10%; 1500 vdcw; JAN type CP70E1EH405V.	High voltage hum filter.	3DB4-387
C104, C105	CAPACITOR, fixed: paper; 4 uf +20% −10%; 600 vdcw; JAN type CP70E1EF405V.	Low voltage hum filter.	3DB4-279
C106	CAPACITOR, fixed: paper; 4 uf +20% −10%; 100 vdcw; JAN type CP53B1EB405V.	Bias hum filter.	3DB4-281
K102, K103	CIRCUIT BREAKER: SPST; AC 115/230 v, 60 cyc, 4.5 amp; 100 kva interrupting capacity.	Protection against overload.	3H900-4.5-1
H104	CLAMP, electrical: 1-7/64″ lg x 1-17/64″ dia o/a; JAN type AN3057-10.	Cable clamp for W101.	2ZK2636-2
H105	CLAMP, electrical: 1-13/64″ lg x 1-3/4″ dia o/a; JAN type AN3507-16.	Cable clamp for W102.	2Z2636-2
H14	CLIP, electrical.	Tuning dial lock.	2Z6195.28
O1, O2	CLIP, electrical: std fuse clip; Littelfuse, part #129002.	Holds electrical contact.	2Z2712.83
0103, 0104	CLIP, electrical: std fuse clip.	Hold interlock short.	2Z2712.83
E4	CONNECTOR, adapter: 500 v peak; 52 ohms nom impedance; UG-27B/U.	Adapter between filter Z1 and connector J5.	2Z7390-27B
J5, J6	CONNECTOR, plug: 1-⅞″ lg x 11/16″ dia o/a; 500 v peak; 52 ohms nom impedance; UG-23B/U.	J5: Connects W2 to adapter E4. J6: Connector W1 to output of filter Z1.	2Z7390-23B
J7	CONNECTOR, plug: 1-1/32″ lg x ¾″ dia o/a; 500 v peak; 52 ohms nom impedance; UG-89/U.	Connects W3 to input panel connector J4.	2Z7390-89
P1	CONNECTOR, plug: 1-¾″ lg x 13/16″ dia o/a; 500 v peak; 52 ohms nom impedance; UG-21B/U.	Connects W2 to cavity connector J9.	2Z7390-21B
P2	CONNECTOR, plug: 31/32″ lg x 27/64″ dia o/a; 500 v peak; 52 ohms nom impedance; UG-88/U.	Connects W3 to cavity input connector J8.	2Z7390-88
P101	CONNECTOR, plug: 2-1/16″ lg x 1-11/32″ dia o/a; 35 amp, 275 v ac, 500 v dc.	Connector for high voltage cable W101.	2Z3062-6
P102	CONNECTOR, plug: 2-5/16″ lg x 1-31/32″ dia o/a; 20-35 amp (2 sizes of cont), 275 v ac, 500 v dc.	Connector for low voltage cable W102.	2Z3032-13
P103	CONNECTOR, plug: straight type; 1-⅛″ lg x 1-17/32″ dia; 10 amp, 250 v.		6Z1727
P301, P302	CONNECTOR, plug: 1 round male cont; straight type; 1-¾″ lg x 13/16″ dia o/a; 52 ohms nom impedance.	Connector for cable.	2Z7390-21B

2. Identification Table of Parts for Amplifier-Power Supply Group AN/TRA-19 (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
J1	CONNECTOR, receptacle: 1-¾″ lg x 1.156″ dia o/a; 35 amp, 275 v ac, 500 v dc; part #AN-3102A-18-16P.	High voltage cable receptacle.	2Z8799-204
J2	CONNECTOR, receptacle: 1-⅞″ lg x 1.782″ dia o/a; 20-35 amp (2 sizes of cont), 275 v ac, 500 v dc; part #AN-3102A-28-9S.	Low voltage cable receptacle.	2Z3073-8
J3	CONNECTOR, receptacle: 1-⅞″ lg x 1″ sq flange o/a; 500 v peak; 52 ohms nom impedance; UG-22B/U.	Panel antenna receptacle.	2Z7390-22B
J4	CONNECTOR, receptacle: 1-¾″ lg x ⅝″ dia; 52 ohms nom impedance; UG-335/U.		2Z7390-335
J8	CONNECTOR, receptacle: 1-1/16″ lg x 11/16″ sq flange o/a; 500 v peak; 52 ohms nom impedance; UG-290/U.	Cavity input receptacle.	2Z7390-290
J9	CONNECTOR, receptacle: 1-⅛″ lg x 1″ sq flange o/a; 500 v peak; 52 ohms nom impedance; UG-58A/U.	Cavity output connector.	2Z7390-58A
E6, E7	CONTACT, electrical: 1-11/16″ lg x 1-1/32″ dia o/a.	Short circuit interlock switch.	3Z7800
E108, E109	CONTACT, electrical: 1-11/16″ lg x 1-1/32″ dia o/a.	Completes a-c power circuit with case removed.	3Z7800
O16	COVER, electrical connector: cap 13/16″ OD; chain 2-9/16″ lg.	Cover for V3.	2Z1612.1
CR1	CRYSTAL UNIT, rectifying: 5 v max continuous reverse working voltage; ½ to ¾ uuf shunt capacitance; type 1N21B.	Rectifies r-f energy in directional coupler.	2J1N21B
I2	DIAL: spur gear; plastic.		2Z4878-1555
H37	FASTENER: Dzus.	Fastens cover to amplifier.	6Z3809-42
H125	FASTENER: Dzus.	Fastens door on panel.	6Z3809-44
F102	FUSE, cartridge: 1/32 amp, 250 v; 1″ lg.	Protection against overload.	3Z2572
F101	FUSE, cartridge: 1/16 amp, 250 v; 1″ lg.	Protection against overload.	3Z2576
E103, E107	FUSEHOLDER: extractor post type; accom 1 cartridge type fuse.	E103: Holds fuse F101. E107: Holds fuse F102.	3Z3275-8
H27	GASKET: neoprene; U-shaped, 2-19/32″ wd x 11/16″ x ¼″ thk.	L1 air gasket.	2Z4866.459
O23	GEAR, spur: brass.	Drives dial.	2Z4878-1556
H121	GROMMET, clamping nylon; fits .656 dia hole; for ⅛″ thk panel.		6Z4865-3
H11, H12	HOSE: 2-9/32″ ID, 4-1/4″ lg.	Blower hose.	3H2546-36
H13	KNOB: rd; phenolic; black; designed to accom shaft rd, flatted, ¼″ dia, 7/16″ d shaft hole.	Knob for rotary switch.	2Z5822-390
I3	LAMP, incandescent: LM-52; 6-8 v, 1 w, .15 amp; 1-⅛″ h o/a.	Illuminates dial and meter.	2Z5952
J10	LIGHT, panel: 6-8 v, .15 amp nom rating.	Holds lamp I3.	2Z5988-35
A207	MOUNT, vibration: 1″ dia x ¾″ h.	Shock mount for amplifier.	2Z8405-167
L101	REACTOR: 10 hy, 230 ma dc; 160 ohms dc resistance; 2500 v rms test voltage; over-all dimen 3-9/16″ lg x 3-1/16″ wd x 3-⅞″ h o/a.	High voltage filter choke.	3C557Z7-2
L102	REACTOR: 10 hy, 40 ma dc; 350 ohms dc resistance; 1500 v rms test voltage; o/a dimen 1-⅞″ lg x 1-¾″ wd x 2-⅜″ h o/a.	Low voltage filter choke.	3C557Z7-1
CR101	RECTIFIER, metallic: selenium; 78 v ac max, single ph; 110 v dc max at no load about 80 v w/load, 22 ma max cur., full wave rectification.	Bias voltage rectifier.	3H4860-225
K101	RELAY, motor driven: SPDT; normally open; 220 v, 10 amp, 60 cyc; ac synchronous motor 115 v, 50-60 cyc; 3-⅞″ h x 2-¾″ dia.		2Z7598-180

2. Identification Table of Parts for Amplifier-Power Supply Group AN/TRA-19 (contd)

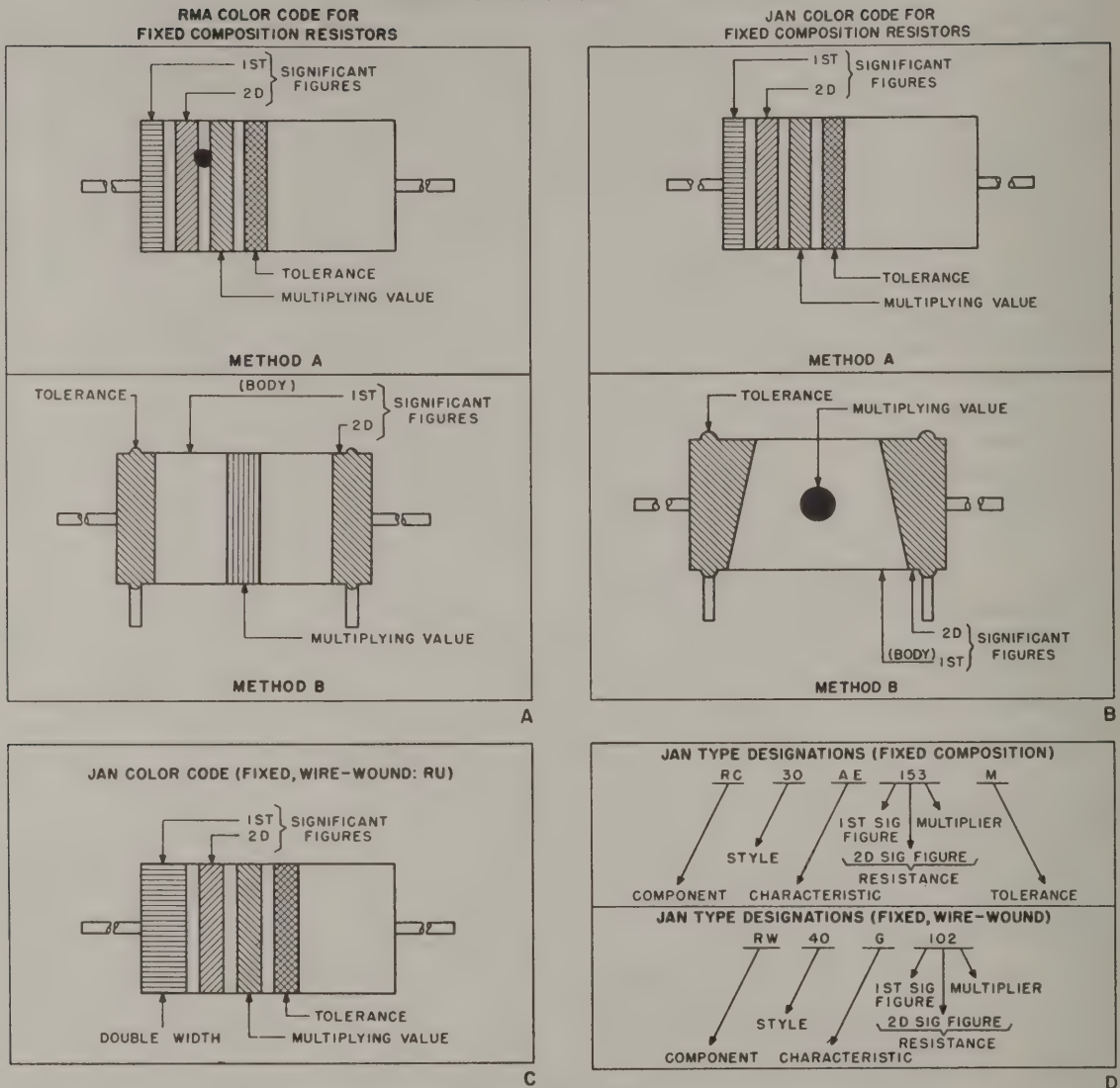
Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R1	RESISTOR, fixed: comp; 33,000 ohms 10%; ½ w; JAN type RC20AE333K.	Lowers screen voltage in tune position of S3.	3RC20BF333K
R2	RESISTOR, fixed: WW; 2.04 ohms 1%; 1/3 w; JAN type RB11B2R04F.	Meter shunt, screen current.	3RB2-2040.2
R3	RESISTOR, fixed: WW; 500,000 ohms 1%; ½ w; JAN type RB13B50002F.	Meter series resistor, screen voltage.	3RB7-5000.4
R4	RESISTOR, fixed: WW; 1 megohm 1%; 1 w; JAN type RB14B10003F.	Meter series resistor, plate voltage.	3RB8-1000.2
R5	RESISTOR, fixed: comp; 150 ohms 10%; ½ w; JAN type RC20AE151K.	R-f load resistor in directional coupler.	3RC20BF151J
R6, R7	RESISTOR, fixed: comp; 1000 ohms 20%; 1 w; JAN type RC30BE102M.	Bias hum filter.	3RC30BF102K
R8, R10	RESISTOR, fixed: comp; 4700 ohms 10%; 2 w; JAN type RC40AE472K.	R8: Grid return and bias bleeder resistor. R10: Self-biasing resistor.	3RC42BF472K
R9	RESISTOR, fixed: WW; 5.26 ohms 1%; ⅓ w; JAN type RB11B5R26F.	Meter shunt, grid current.	3RB2-5260
R11	RESISTOR, variable: WW; 10,000 ohms 10%; 2 w; JAN type RA20A1SD103AK.	Meter calibrate r-f power output.	3RA7548
R12	RESISTOR, fixed: comp; 100,000 ohms 10%; ½ w; JAN type RC20BE104K.	Limits high voltage at position 2 of S4.	3RC20BF101J
R101	RESISTOR, fixed: WW; .251 ohms 1%; ⅓ w; JAN type RB15ER2510F.	Meter shunt, cathode current.	3RB1-2510.1
R102	RESISTOR, fixed: WW; 46,000 ohms 5%; 110 w; JAN type RW38G463.	High voltage bleeder resistor.	3RW34801
R103	RESISTOR, fixed: comp; 100,000 ohms 10%; 2 w; JAN type RC40BE104K.	Low voltage supply bleeder resistor.	3RC42BF104K
R104	RESISTOR, fixed: comp; 470,000 ohms 10%; ½ w; JAN type RC20BE474K.	Plate resistor for d-c amplifier.	3RC20BF474K
R106, R108	RESISTOR, fixed: comp; 22,000 ohms 10%; 2 w; JAN type RC40BE223H.	Bias setting bleeder resistor.	3RC42BF223K
R107	RESISTOR, fixed: comp; 120,000 ohms 10%; ½ w; JAN type RC20BE124K.	Voltage reference tube current adjuster.	3RC20BF124K
R109	RESISTOR, fixed: comp; 1 megohm 10%; ½ w; JAN type RC20BE105K.	Grid suppressor.	3RC20BF105K
R110	RESISTOR, fixed: comp; 33,000 ohms 10%; 2 w; JAN type RC40BE333K.	Cathode bias resistor.	3RC42BF333K
R111	RESISTOR, fixed: comp; 11,000 ohms 5%; 2 w; JAN type RC40AE113J.	Bias limiting resistor.	3RC42BF113J
R112	RESISTOR, variable: WW; 3000 ohms 10%; 4 w; JAN type RA30A1SD302AK.	Screen voltage adjustor.	3RA6615
O24	RETAINER, ball bearing: brass; 9/16″ lg x ⅜″ dia.		3H302-1
E104	SHIELD, electron tube: JAN type TSFOT103.	Retains V104 in socket.	2Z8304.277
E105	SHIELD, electron tube: JAN type TS103U02.	Retains V105 in socket.	2Z8304.275
E106	SHIELD, electron tube: JAN type TSFOT102.	Retains V106 in socket.	2Z8304.276
X1	SOCKET, electron tube: 8 cont; 2-¾″ dia x 13/16″ h.	For mounting tube V1.	2Z8670.50
X101, X102, X103	SOCKET, electron tube: octal; JAN type TS101P02.	X101: Socket for V101. X102: Socket for V102. X103: Socket for V103.	2Z8678.326
X104, X106	SOCKET, electron tube: miniature; JAN type TS102P01.	X104: Socket for V104. X106: Socket for V106.	2Z8677.94
X105	SOCKET, electron tube: miniature; JAN type TS103P01.	Socket for V105.	2Z8679.30

2. Identification Table of Parts for Amplifier-Power Supply Group AN/TRA-19 (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O106, O107, O108, O109, O110, O111, O112, O113	SPACER: approx 7/16″ lg, .228″ OD, .171″ ID, flange .562″ dia; for #6 bolt.	O106, O107, O108, O109: Mounting E101. O110, O111, O112, O113: Mounting E102.	3H5247-22
S1, S2	SWITCH, interlock: door type; 10 amp ac or dc, 110 or 220 v; SPST.	Interrupts a-c power when chassis is removed.	3Z9560-7
S3	SWITCH, toggle: SPST; 40 amp, 900 v ac; JAN type ST42A.	OPERATE TUNE switch.	3Z9863-42A
S4	SWITCH, rotary: 2 sect.; 7 positions.	Meter switch.	3Z9825-62.731
S101, S102	SWITCH, toggle: DPDT; 30 amp, 900 v ac; JAN type ST52N.	115-230 volt line switch.	3Z9863-52N
S103, S104	SWITCH, interlock: door type; 10 amp ac or dc, 110 or 220 v.	Disconnects a-c power when chassis is removed.	3Z9560-7
T101	TRANSFORMER, power: step-up; input data 115/230 v ac, 50-60 cyc, single ph; 1 output wdg, 1600 v, 230 ma dc, secd center tapped plus two additional taps on either side of center, latter taps rated 760 v, 40 ma dc; 2500 v insulation; 5-⅞″ lg x 4-¾″ wd x 6-⅝″ h.	High voltage transformer.	2Z9621.504
T102	TRANSFORMER, power: step-up and step-down; 115/230 v, 50-60 cyc, single ph; 4 output wdg, #1 secd 115 v, #2 secd 6 v, #3 secd 5 v, #4 secd 5 v; #1 secd 520 ma, #2 secd 3.5 amp, #3 secd 2 amp, #4 secd 4 amp; #2, #3, #4 secd center tapped; 4-5/16″ lg x 3-11/16″ wd x 4-½″ h.	Filament and blower transformer.	2Z9621-505
T103	TRANSFORMER, power: step-down; 115/230 v ac, 50-60 cyc, single ph; 3 output wdg, #1 secd 50 v, #2 secd 6.3 v, #3 secd 6.3 v; #1 secd 10 ma, #2 secd .45 amp, #3 secd .3 amp; 1-⅞″ lg x 1-¾″ wd x 2-⅜″ h.	Bias and auxiliary filament transformer.	2Z9621-503
V1	TUBE, electron: type 4X150A.	R-f amplifier.	2J4X150A
V101, V102, V103	TUBE, electron: full-wave high vacuum rectifier; type 5R4WGY.	Low voltage rectifier.	2J5R4WGY
V104	TUBE, electron: type 6AQ5.	Electronic voltage regulator.	2J6AQ5
V105	TUBE, electron: twin triode; type 12AT7.	Direct current amplifier.	2J12AT7
V106	TUBE, electron: type 5651.	Voltage reference tube.	2J5651
H24	WRENCH, spanner: spanner one end, other open end hex.; approx o/a dimen, 5½″ lg x 2″ wd; material ⅛″ thk; pins protrude ⅛″ ea side; 3/16″ slot for mtg on #8 screw.	Wrench for L1 and Z1.	6R57523-3
H32	WRENCH: socket head screw; TL-567/U; Allen setscrews #5 and 6.	For backlash setscrew in O4.	6R57400-6

INDEX

RESISTOR COLOR AND LETTER CODE



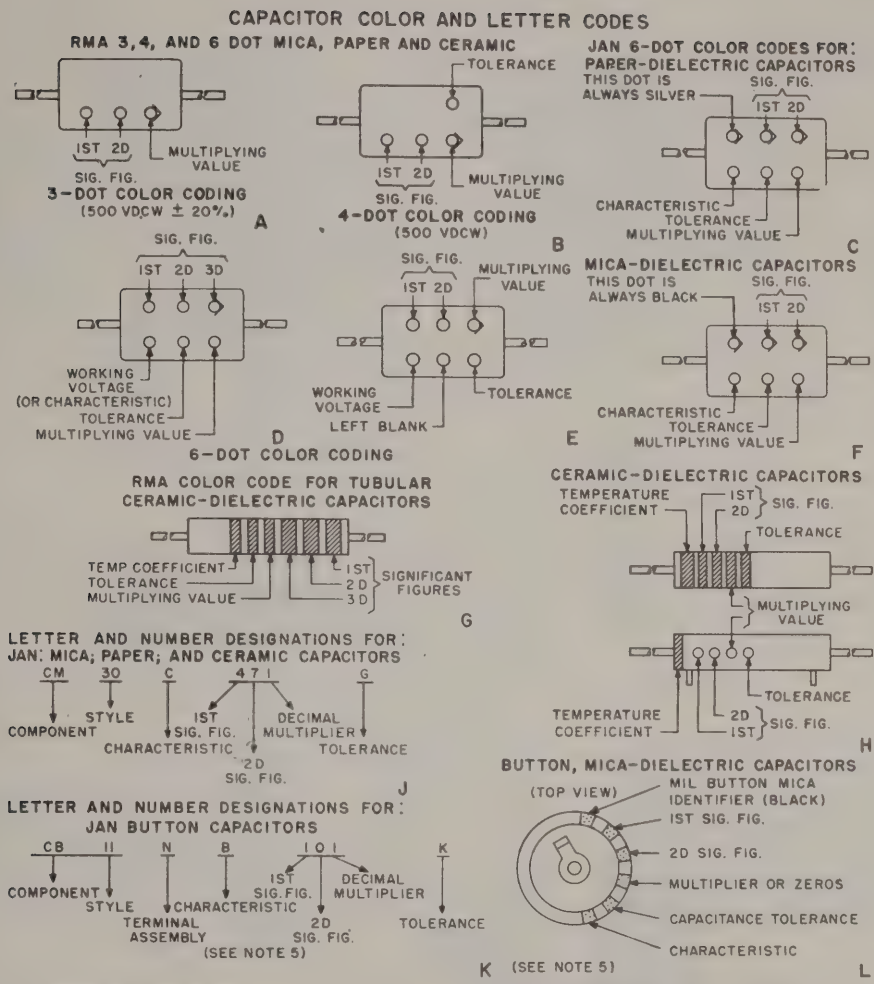
STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	–	–
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	–
YELLOW	4	10,000	± 4	–
GREEN	5	100,000	± 5	–
BLUE	6	1,000,000	± 6	–
VIOLET	7	10,000,000	± 7	–
GRAY	8	100,000,000	± 8	–
WHITE	9	1,000,000,000	± 9	–
GOLD	–	0.1	± 5	J
SILVER	–	0.01	±10	K
NO COLOR	–	–	±20	M

NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

Figure 36. Resistor color codes.



- STANDARDS -					JAN MICA-CM		JAN PAPER-CN			JAN CERAMIC-CC				
										CAP. TOL. FOR MORE THAN 10 UUF		CAP. TOL. FOR 10 UUF OR LESS		
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARAC-TERISTIC	LETTER TOL.	CHARAC-TERISTIC	DEC. MULT.	%	LETTER DESIG-NATION	UUF	LETTER DESIG-NATION	CHARAC-TERISTIC
BLACK	0	. 1	±20	500	M	A	M	.A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-	-	±20	500	-	-	-	-	-	-	-	-	-	-
* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±3%														

NOTES

JAN: JOINT ARMY-NAVY
RMA: RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   CB MICA BUTTON: *CC* CERAMIC; *CM* MICA MOULDED: *CN* PAPER MOULDED

TM CC

Figure 37. Capacitor color codes.

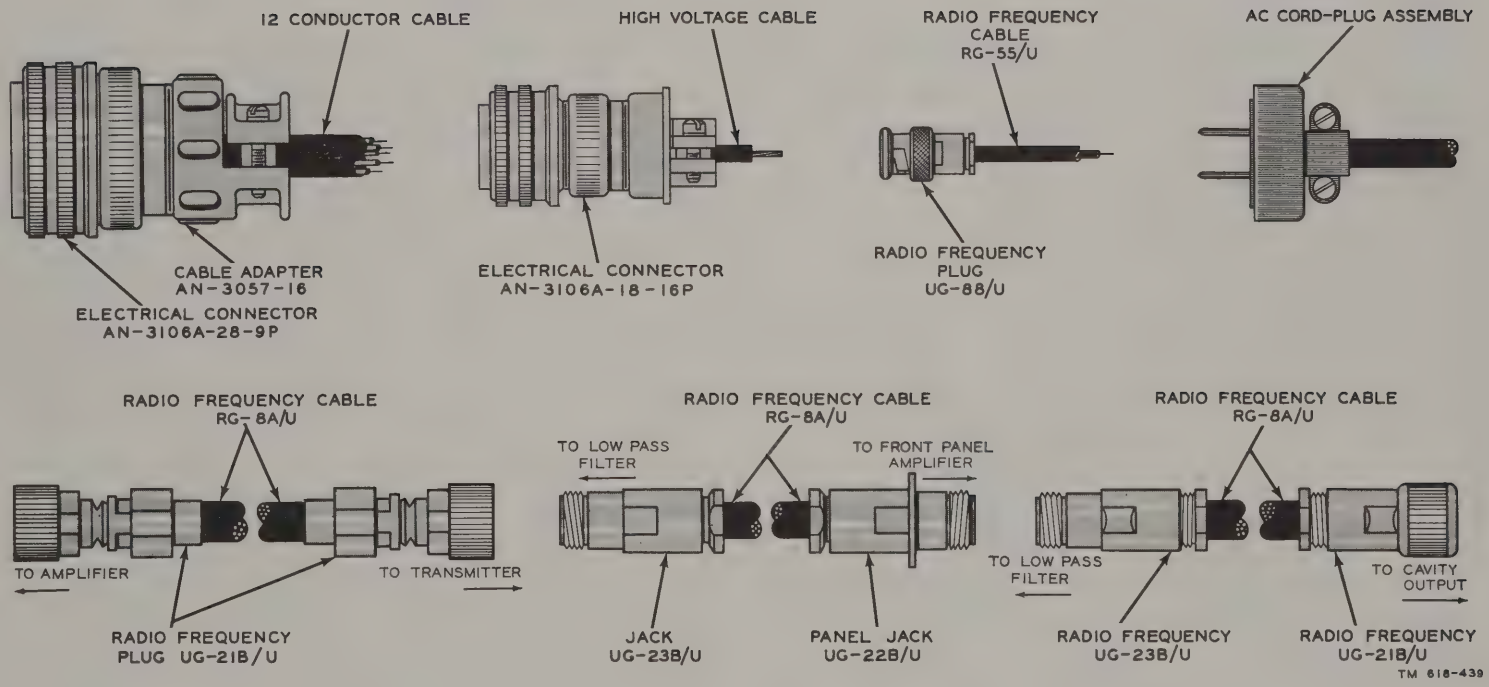
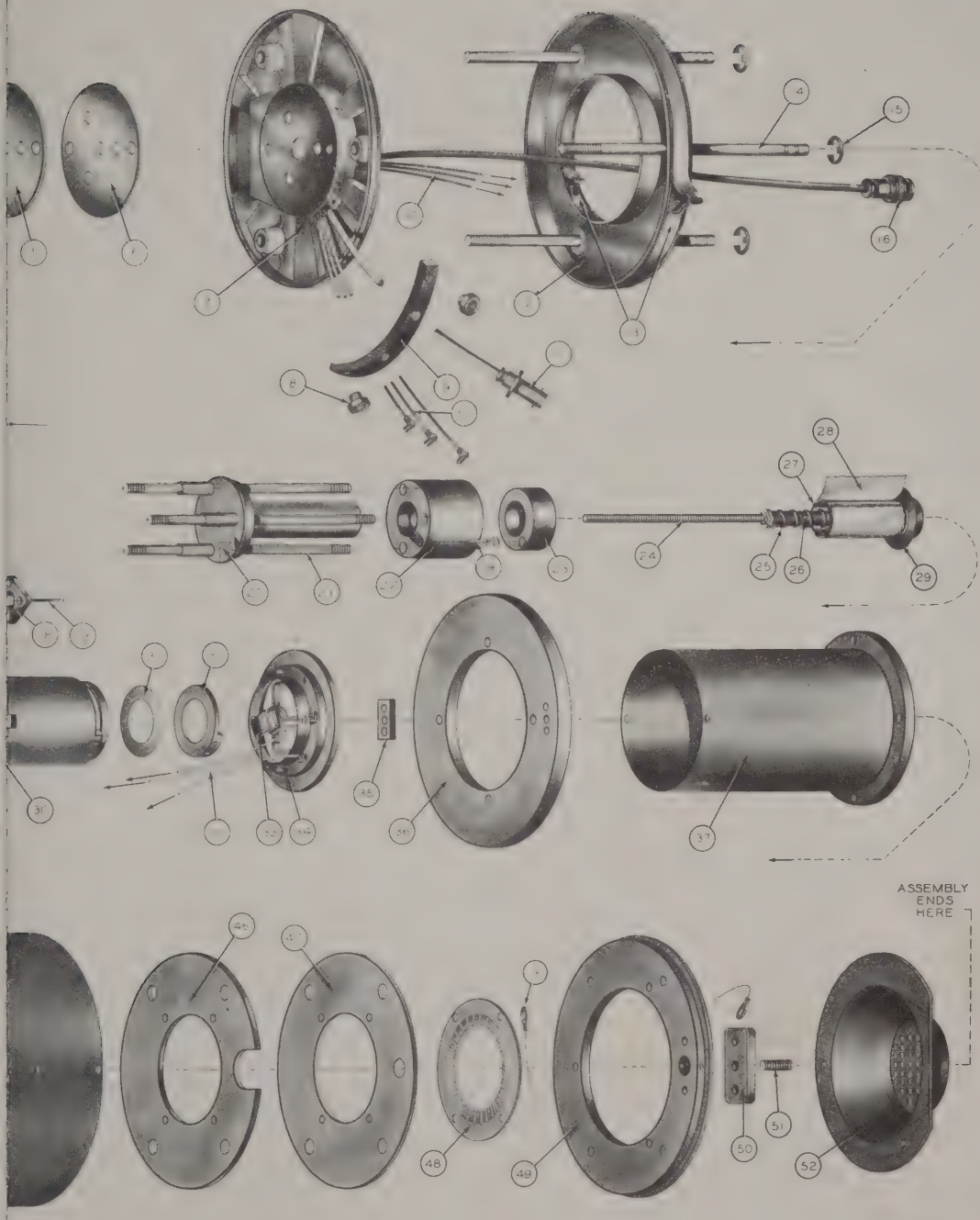


Figure 38. Amplifier-Power Supply Group AN/TRA-19, cord and plug assemblies.



d view of cavity.

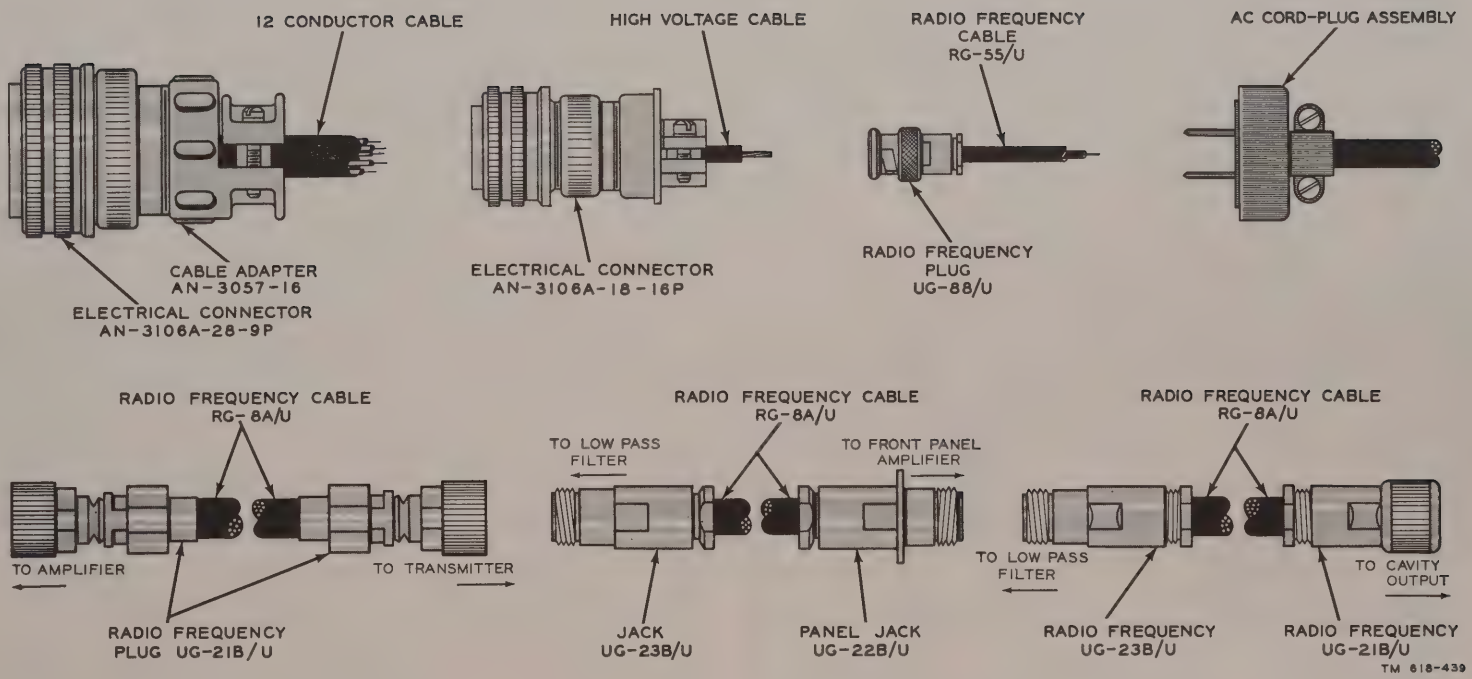
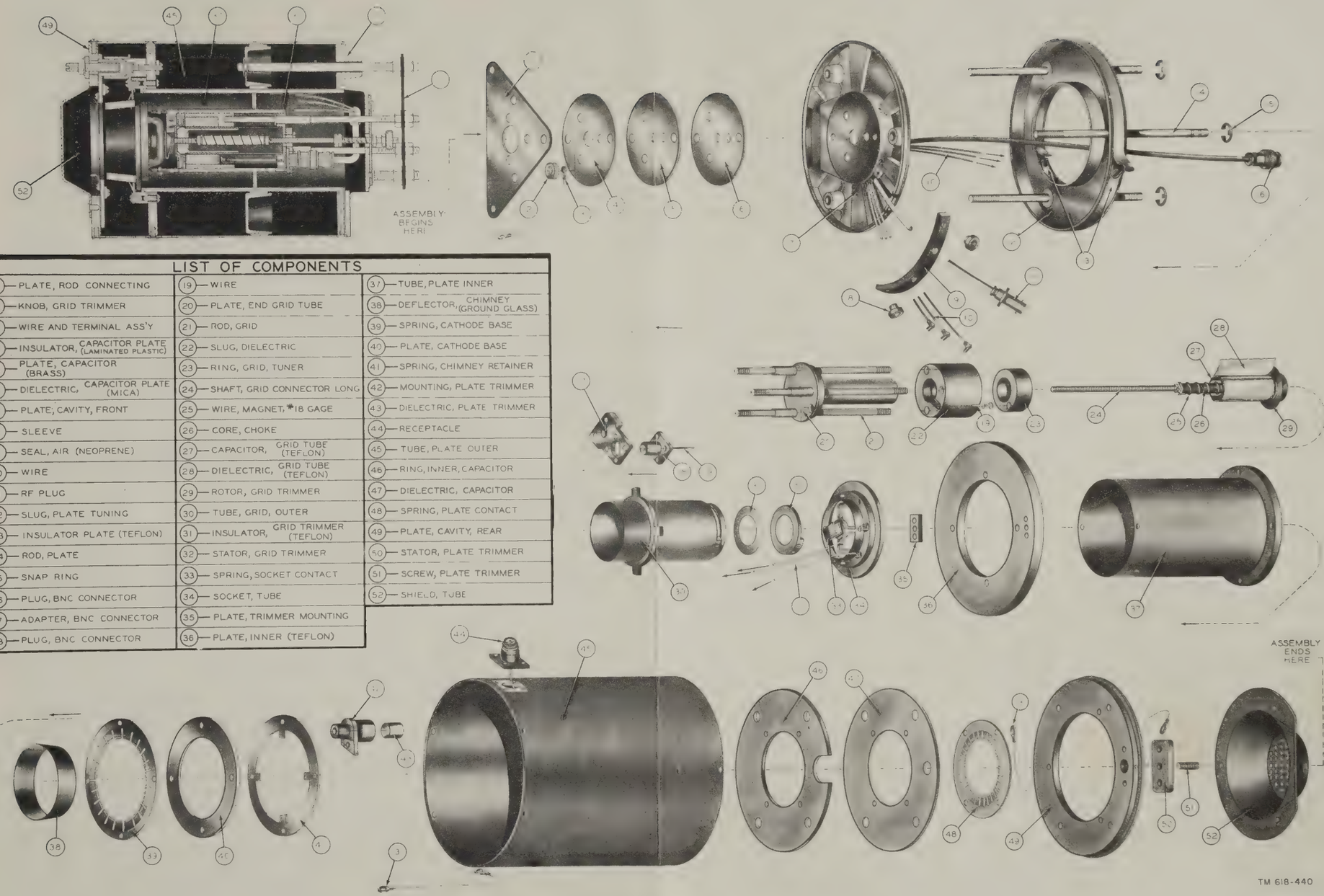


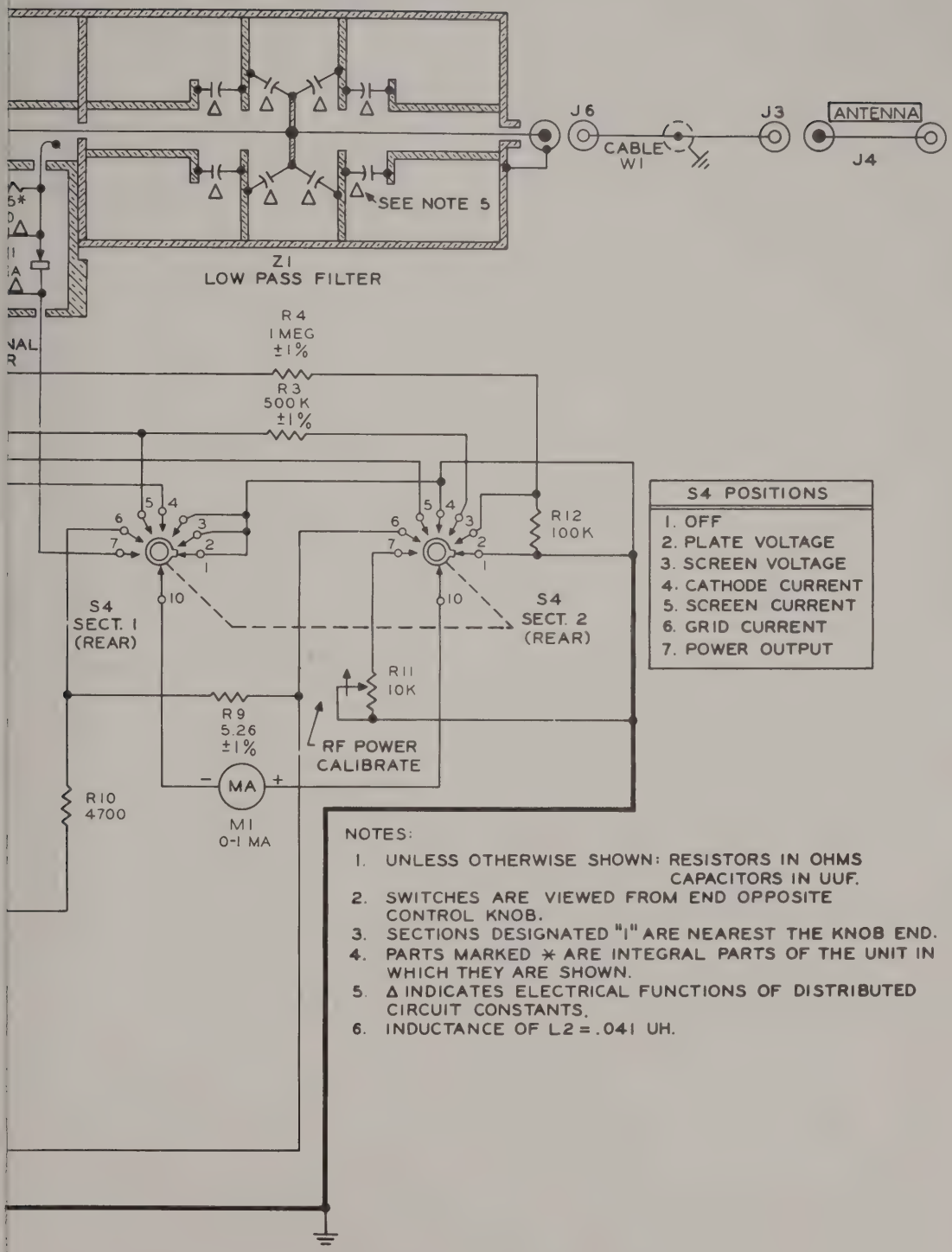
Figure 38. Amplifier-Power Supply Group AN/TRA-19, cord and plug assemblies.



LIST OF COMPONENTS

1 — PLATE, ROD CONNECTING	19 — WIRE	37 — TUBE, PLATE INNER
2 — KNOB, GRID TRIMMER	20 — PLATE, END GRID TUBE	38 — DEFLECTOR, CHIMNEY (GROUND GLASS)
3 — WIRE AND TERMINAL ASS'Y	21 — ROD, GRID	39 — SPRING, CATHODE BASE
4 — INSULATOR, CAPACITOR PLATE (LAMINATED PLASTIC)	22 — SLUG, DIELECTRIC	40 — PLATE, CATHODE BASE
5 — PLATE, CAPACITOR (BRASS)	23 — RING, GRID, TUNER	41 — SPRING, CHIMNEY RETAINER
6 — DIELECTRIC, CAPACITOR PLATE (MICA)	24 — SHAFT, GRID CONNECTOR LONG	42 — MOUNTING, PLATE TRIMMER
7 — PLATE, CAVITY, FRONT	25 — WIRE, MAGNET, *18 GAGE	43 — DIELECTRIC, PLATE TRIMMER
8 — SLEEVE	26 — CORE, CHOKE	44 — RECEPTACLE
9 — SEAL, AIR (NEOPRENE)	27 — CAPACITOR, GRID TUBE (TEFLON)	45 — TUBE, PLATE OUTER
10 — WIRE	28 — DIELECTRIC, GRID TUBE (TEFLON)	46 — RING, INNER, CAPACITOR
11 — RF PLUG	29 — ROTOR, GRID TRIMMER	47 — DIELECTRIC, CAPACITOR
12 — SLUG, PLATE TUNING	30 — TUBE, GRID, OUTER	48 — SPRING, PLATE CONTACT
13 — INSULATOR PLATE (TEFLON)	31 — INSULATOR, GRID TRIMMER (TEFLON)	49 — PLATE, CAVITY, REAR
14 — ROD, PLATE	32 — STATOR, GRID TRIMMER	50 — STATOR, PLATE TRIMMER
15 — SNAP RING	33 — SPRING, SOCKET CONTACT	51 — SCREW, PLATE TRIMMER
16 — PLUG, BNC CONNECTOR	34 — SOCKET, TUBE	52 — SHIELD, TUBE
17 — ADAPTER, BNC CONNECTOR	35 — PLATE, TRIMMER MOUNTING	
18 — PLUG, BNC CONNECTOR	36 — PLATE, INNER (TEFLON)	

Figure 39. Exploded view of cavity.



NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS IN OHMS CAPACITORS IN UUF.
2. SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
3. SECTIONS DESIGNATED "1" ARE NEAREST THE KNOB END.
4. PARTS MARKED * ARE INTEGRAL PARTS OF THE UNIT IN WHICH THEY ARE SHOWN.
5. Δ INDICATES ELECTRICAL FUNCTIONS OF DISTRIBUTED CIRCUIT CONSTANTS.
6. INDUCTANCE OF L2 = .041 UH.

TM618-441

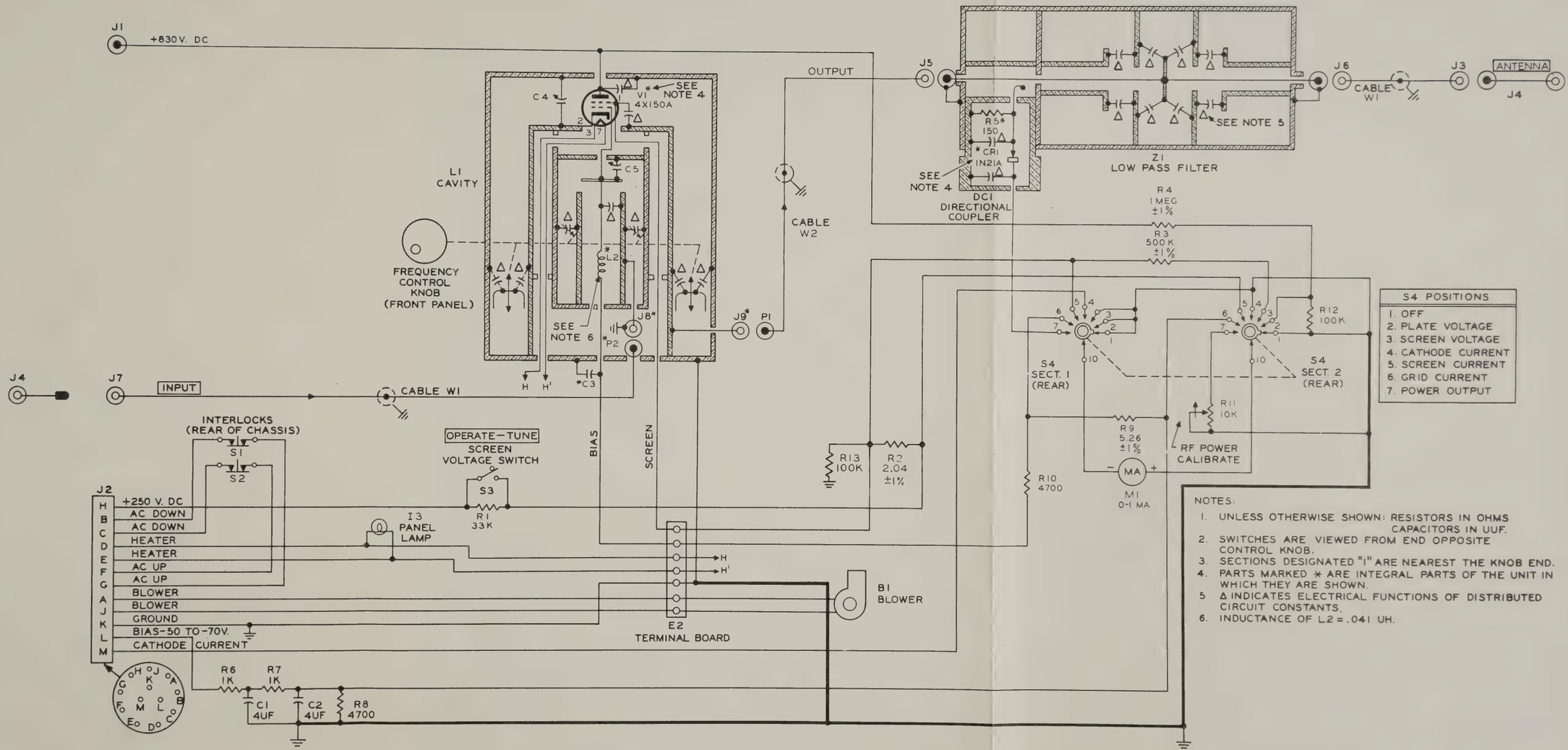


Figure 40. Radio Frequency Amplifier AM-456/TRA-19, schematic diagram.

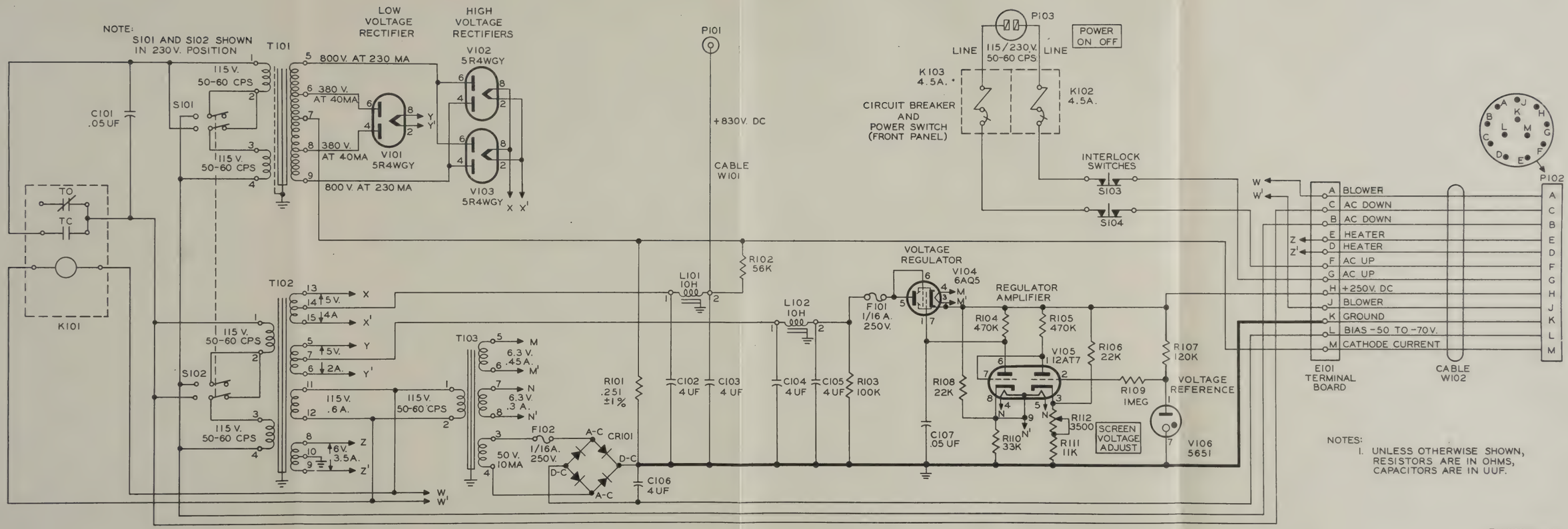


Figure 41. Power Supply PP-840/TRA-19, schematic diagram.

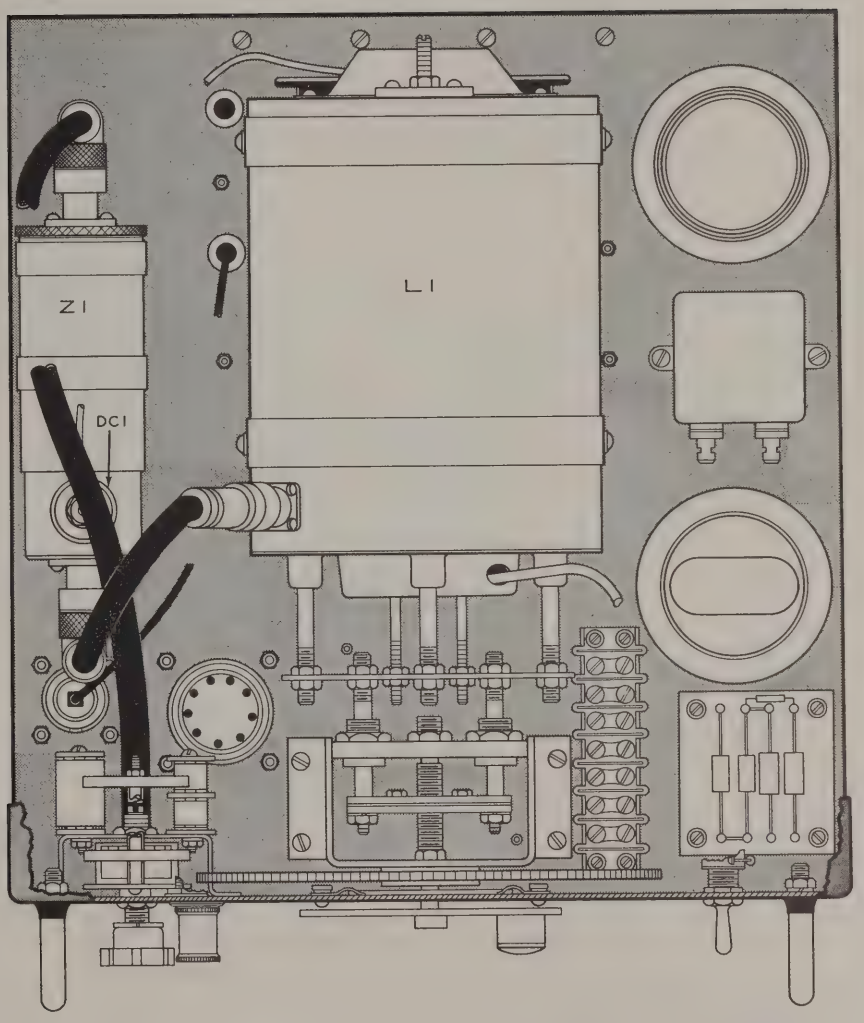


Figure 42. Parts location, top of amplifier.

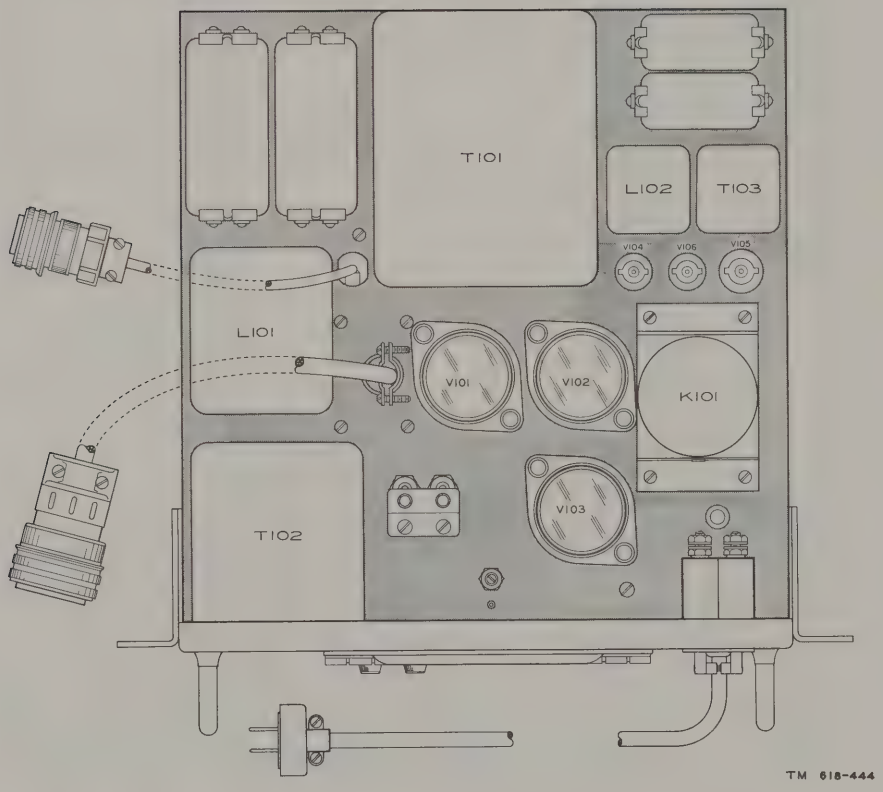


Figure 43. Parts location, top of power supply.

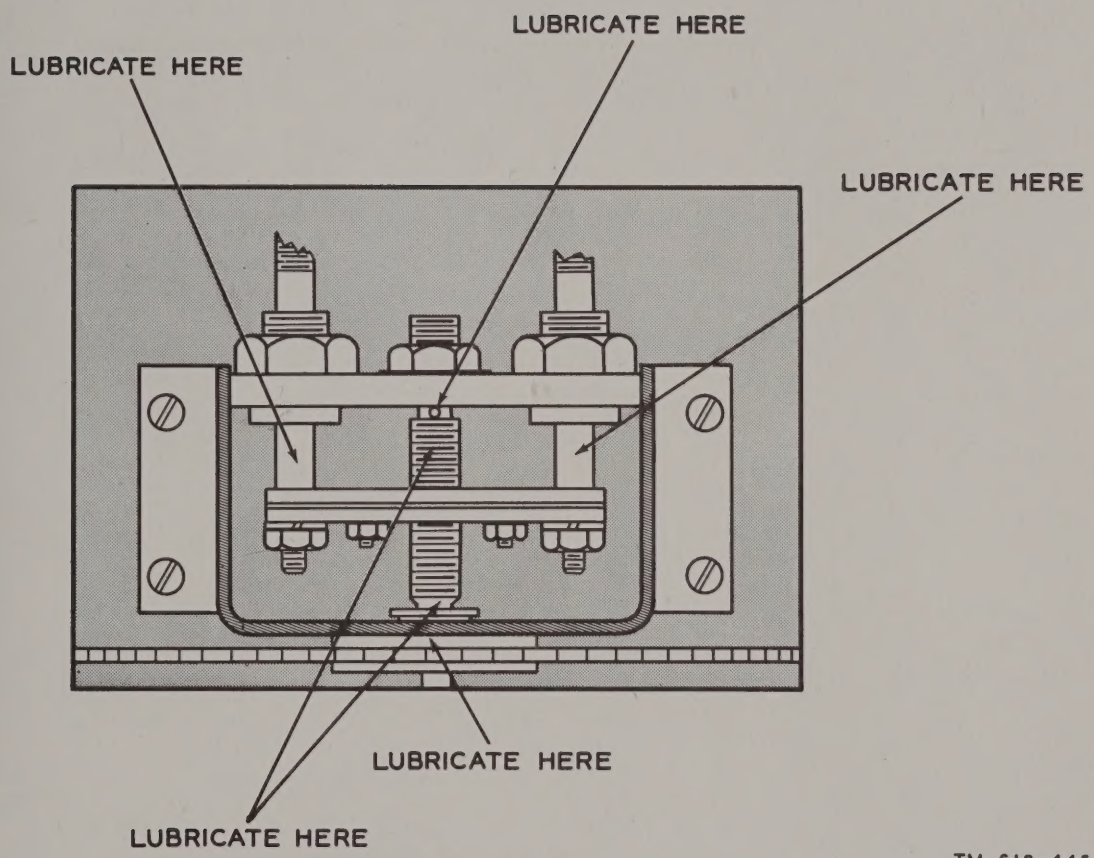


Figure 44. Dial Drive lubrication points.